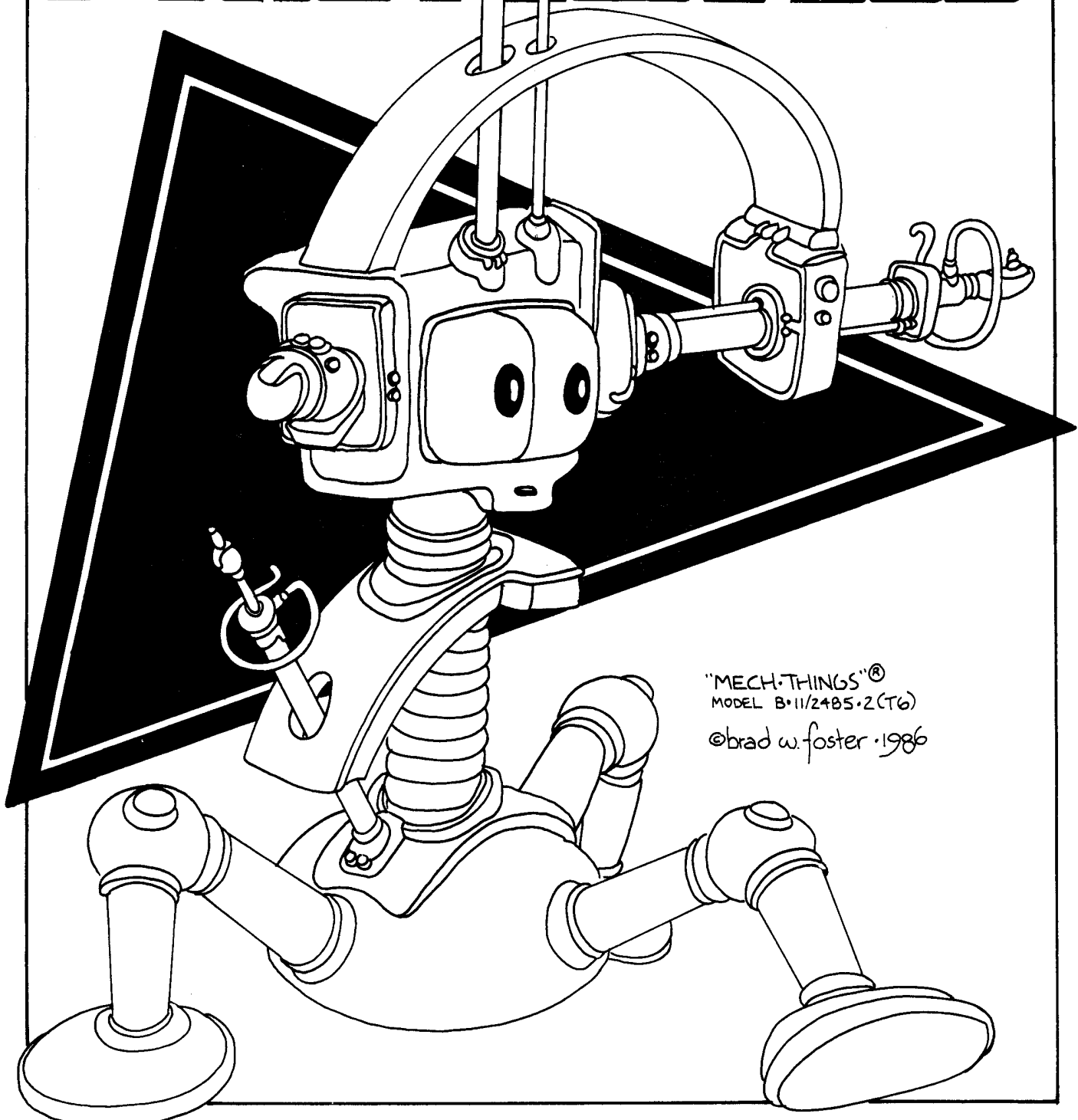


PYROTECHNICS



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**GENERAL
TECHNICS**

PYROTECHNICS #38, edited and published by Gail and Jamie Hanrahan, under the auspices of White Rabbit Press (our motto: "I'm late! I'm late!"). PYROTECHNICS purports to be a general-interest fanzine focusing on (but not exclusively devoted to) hard sf and real-world science and technology. It also serves as the newsletter of the organization club mob of tech-minded fen known as General Technics whenever any of them deigns to send us any news (which they have; see pages 11 through 23 for a report on the Worldcon Hotel Atrium Blimp Project!).

Pyro is available for The Usual: Letters of comment, artwork, articles, cartoons, anything else we can publish (surprise us!), and most especially in exchange for other fanzines. It is also available by subscription at the rate of \$3/four issues, and while it is fashionable in fanzine circles to make disparaging remarks about those who "only" send money, we have found it quite difficult to buy paper and postage with LOCs and tradezines! Anyway, to receive PYROTECHNICS, send one (or more) of the above to:

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at least once a year or so. (Make checks payable to one of us personally, not the zine.) LOCs and text-only contributions can also be mailed electronically via Usenet to

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By next issue we should have our ultra-spiffy computerized mailing label generator working. Then we'll be able to automagically put codes on the label that'll be keyed to a list printed here. Admittedly this will be a little impersonal, but it'll beat all hell out of manually checking boxes on the inside pages of 300-odd fanzines. For now, please note that if there's an asterisk (*) in front of your name on the mailing label, the computer will not generate a label for you next time unless either (a) you Do Something (see above) or (b) we notice and decide to send you one or two more issues. We would like to continue sending Pyro to everyone who's interested, so if you are interested, please let us know!

WHY TIMES ARE HARD FOR HARD SF

by James Brunet
(uucp: sdcsvax!sdcrcdf!ism780!
ism780c!jimb)

Like many SF readers, I grew up with an affinity for hard science fiction; it was the natural bent of any young science-oriented student in those days before Tolkien became a household word and shelf after shelf of fantasy inundated your local bookstore. Today, I find very little hard SF that is really good, Sturgeon's Law notwithstanding. The demand for hard SF is strong; yet editors and publishers complain that not enough saleable hard SF is being presented to them. And as the quantity of hard SF has fallen, so has the quality. The Bears, Brins, Benfords, Nivens and Vinges are all too few. Why, then, the hard times for hard SF?

I suggest three reasons for the dwindling of hard SF: The expansion of the frontiers of science, the literary coming of age of SF, and ultimately, the excess demands placed upon hard SF by its admirers.

THE EXPANDING FRONTIER OF SCIENCE

Twenty years ago, SCIENTIFIC AMERICAN was for the most part accessible to the knowledgeable lay reader; today, most articles are written by specialists for specialists. In a nutshell, this is symptomatic of all science in the past quarter-century.

In 1960, it was possible for the educated layman to have a moderately decent comprehension of what was happening at the boundaries of physics, astronomy, and biochemistry. In the interval since, fields of knowledge have converged, merged, and diverged again to form an array of specialties such that it is all but impossible for, say, a physicist to be aware of the facts, nuances, and implications of more than two or three specialties other than her own.

What are the implications for the would-be writer of hard SF? It is simply impossible to keep up with the new theories of constructs of all science. One can read SCIENCE NEWS, SCIENCE 8x, and one or two professional journals -- assuming that one has the requisite background -- and still not have more than a superficial understanding of the current view in most scientific disciplines. Assume that additional research will be done on the most salient scientific disciplines of a given story, and there will still be large gaps where the writer will be left to rely on out-dated popular views or dated memories of high school or college lectures.

Hence, it is not at all surprising if we read a story where a writer has gotten the astrophysics and artificial intelligence aspects correct only to bungle the biology or the psycho-chemistry. The writer has ways around this, of course, such as reducing the scope of the story or finessing some questions by stating a technological result with no indication of how it was achieved -- hyperspace travel being a typical example of the latter. And yet there are times when the finessing and hand-waving simply will not do -- when the story will wither without a fuller explanation. In such cases, we read out-dated science or science with holes and improbabilities.

Some might say, "Well, do more research." For the novel, this is sometimes a possibility. Greg Bear is one of the best hard SF writers today. As a non-scientist, Greg compensates by doing an extreme amount of research; it doesn't hurt that he is also generously endowed with intellectual faculties. But Greg has an advantage that most SF writers don't: His writing career is a full-time pursuit. The great majority of SF writers find it necessary to hold part-time or full-time jobs to buy groceries, keep a roof over their heads, contribute to the support of their families, etc. In this situation, research time is a direct trade-off with writing time. What profit gaineth the writer if he learns his subjects but hath not the time to produce? After all, the business of a writer is writing, and for most there must be some hope of reasonable economic return for time invested.

If intense research is a difficult proposition for the writer of the SF novel, it is all but impossible for the short story writers. Ugly economic reality again comes into play. To keep the lupine beastie from the portal, short story writers must, in general, turn out their stories quickly. The established pro who writes shorter work needs to produce quickly to justify the income; the aspiring amateur must turn stories out quickly to gain experience and to maximize the possibility of sales. Research is a luxury and time is the excise tax that most short story writers simply can't afford to pay. And because most beginning writers begin with short stories, an entire generation of SF writers is learning its craft without the regular exposure to intense research. These writers face hard choices when they graduate to novel-length work: Acquire the inclination to do the research hard SF requires, or forswear hard SF for less demanding endeavors.

SF COMES OF AGE

To some extent, all science fiction is a victim of its own success. Its popularity has meant ever-wider audiences, to the point where SF regularly makes the best seller list. With the wider audiences, and with its coming of age as a literary form, the literary standards have risen. No longer is a great plot alone sufficient to garner praise, justify publication, and -- most important to an editor or publisher -- make money; SF must have the same standards of depth-of-character and deftness of execution as other literary forms.

What does this mean for hard SF? The scientifically and technically inclined still constitute a small minority in our society. Those who have the literary skills to be good writers, possessing the balance of intellection and intuition, a command of language, and a sensitivity to human character, constitute an even smaller minority. The intersection set of these two groups is smaller still. Raise the literary standards and the set of good writers diminishes even further, making the intersection set even smaller. This is what has happened to hard SF. Just as expanding frontiers of science have made it more difficult for the writer to stay scientifically cognizant, rising literary standards have short-circuited a number of writing careers.

This is not to say that only superior work is being published. There is still a lot of "crud" on the market; as it is, so it ever was. But it does mean that writers who have the hard science handled correctly do not necessarily receive the great recognition, sales, and popularity that they might have in an earlier time. Robert Forward and James Hogan come to mind in this regard. Hogan in particular I desperately want to like. I like his ideas and I like the man, from what I know, but his writing has left a lot to be desired. (I haven't read his latest and I'm told that the writing has improved dramatically, so here's hoping.)

Faced with the lukewarm popularity of scientifically correct but literarily weak work, publishers are going to be cautious in publishing same, feeding enough to supply the core demand and no more. The public's tolerance for "weak" fantasy seems much higher, perhaps because it's more broadly accessible. Hence, the shelf after shelf of Tolkien magic-sword-and-quest knock-offs.

EXCESS DEMANDS UPON HARD SF BY ITS READERS

If part of the responsibility for hard times for hard sf rests with the writer, part with economic realities, and part with changing literary standards, then a final part of the responsibility rests squarely with readers of hard SF who expect too much of the genre.

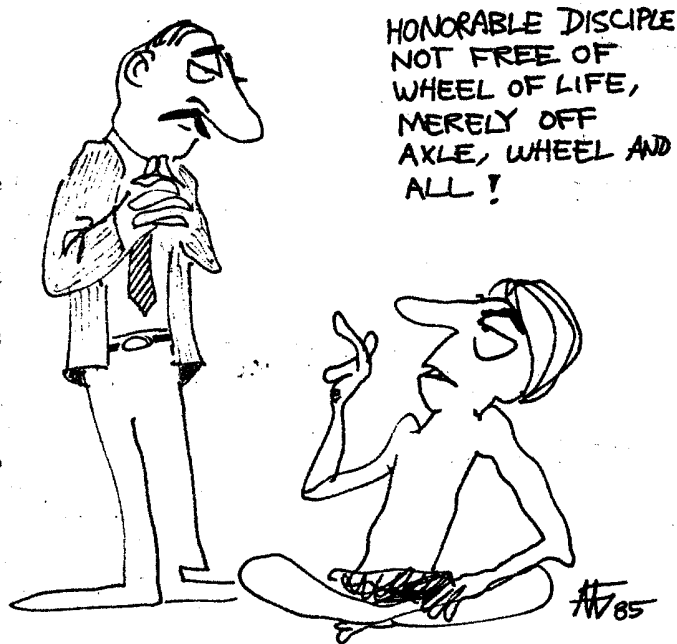
Hard science fiction is, first and foremost, fiction. Fiction is an art form, and as such is much more closely akin to painting than, say, photography. The purpose of fiction is not to capture precisely "what is" or "what might be", but to suggest an external reality -- and, through that reality, to develop a psychic landscape in the mind of the reader. This landscape includes not only the physical elements of the story, but also the emotional, moral, and tonal elements. Using the metaphor of impressionistic painting, what matters is not the precise rendering of line and color, but whether or not that aggregate impression conveys not only a reality, but Truth.

Some readers complain about inaccuracies encountered in SF stories. The question that should always be asked is, "Does it matter?" Roger Zelazny wrote "The Doors of His Face, the Lamps of His Mouth" in 1965, knowing that the space probe data was going to render his view of Venus obsolete. He wrote the story quickly, wanting to get one good story set on Venus before his view became untenable. The story was an award-winner; was it suddenly transformed from a good story to a bad one when fact and theory changed? No; the story is as fine a read today as it was when it was written.

Readers should remind themselves that SF is fiction. Even David Brin and Greg Benford -- two of the best among contemporary hard SF writers -- have scientific "mistakes" in their work. Brin, for instance, has acknowledged that he overstated the current intelligence of dolphins as imputed in Startide Rising. Does this weaken a wonderful tour de force of a novel? No. The more ambitious and broadly based a story, the more difficult -- both technically and artistically -- it is to have everything technically correct. Ultimately, fictional reality is not the same as reality.

If a reader must have 100% accurate science instead of general accuracy to two significant figures, he is better advised to read a textbook. Better, considering how textbooks become obsolete by the time they appear in print, read the scientific journals instead, taking care to spot the errors appearing there.

(continued on page 45)





BEYOND THE BLURBS

Pyro Looks at Books

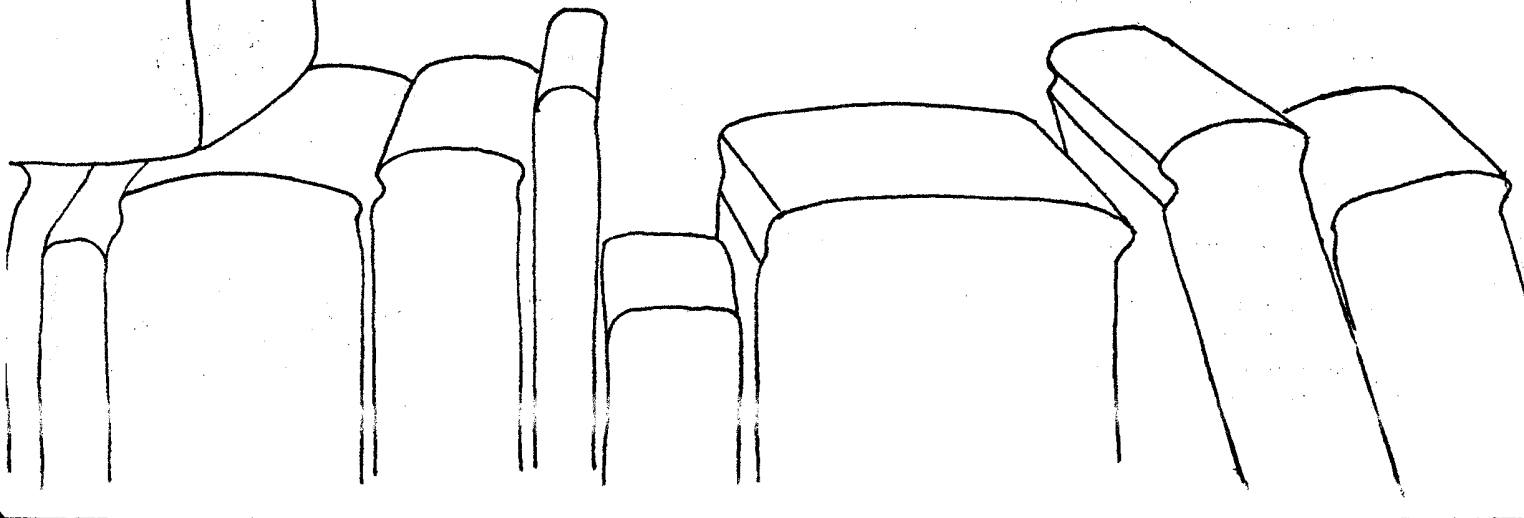
BLOOD MUSIC by Greg Bear
Arbor House, 1985, \$14.95

reviewed by Barry Gehm

Greg Bear gets an A. Greg Bear gets a gold star. He can even stay after class and clean the erasers. Greg Bear has done his homework.

Blood Music tells the story of a biology experiment gone awry, the oldest idea in science fiction, if you agree with Brian Aldiss's contention that Frankenstein was the first sf novel. But Mr. Bear uses the recent scientific revolution known as molecular biology, or, more popularly, genetic engineering, to present a menace far more deadly than anything out of Mary Wollstonecraft Shelley's nightmares.

Further, Mr. Bear provides an elaborate and highly plausible scientific background for his story. This is hard sf, make no mistake about it. Mr. Bear didn't. He has clearly done more than just pick up a bit of the jargon so his characters can toss buzzwords at each other; rather, it appears he has acquired a good understanding of the materials and methods of molecular biology. More, he has a sure touch in portraying scientific personalities and the ambience of the laboratory. The opening chapters practically ooze verisimilitude, and Vergil Ulam's lab at Genentron is the most convincing fictional lab I have ever encountered. (I should pause here for a moment to establish credentials. I'm a biochemist, not a molecular biologist, though I have transferred a gene or two in my time (hold the jokes). I'm not an expert on genetic engineering, but I believe I know enough to be a tough audience. In fact, I did find two and a half very trivial errors, which, if you really want to know, are described in the footnote below(*), just so you don't think I've gone soft.) Do I really believe, deep down, that intelligent microbes that use DNA



like random access memory can be engineered? No. Do I think that the accuracy and sophistication of the scientific exposition in Blood Music are up to the highest standards of hard sf? You bet.

Would that Blood Music were as flawless novelistically as it is scientifically, but such is not the case. There are, to my mind, some problems with the plot. (WARNING: The discussion below reveals some aspects of the resolution of the story. If you have not read Blood Music and your enjoyment of the novel would be diminished by such knowledge, do not read the rest of this paragraph, or the next one.) In the form of an intelligent plague capable of directing its own evolution, Mr. Bear has created a monster so effective that it is unstoppable. No human efforts can defeat it, yet Mr. Bear is determined that the novel should have an upbeat ending. He spends most of the latter two-thirds of the book depicting the worsening situation as the descendants of Ulam's lymphocytes take over North America despite all attempts to stop them, then pulls a rabbit out of his hat. Space-time, he says, can withstand only so much observation, and billions of trillions of intelligent microscopic observers are putting a strain on things. Eventually they create a kind of informational singularity and disappear. The idea that space-time cannot stand more than a certain number of observers does not grow organically from the original premise and is not developed from the outset (some foreshadowing is levered in about two-thirds of the way through the book). It's not a bad science-fictional idea at all, and no less plausible than a lot of what passes for serious physics these days, but it damages the structure of the novel by being introduced ad hoc as a way for the author to escape the logical consequences of his scenario. A clever rabbit, but still a rabbit.

Another narrative infelicity is the handling of the four characters who survive the wholesale absorption of the population of North America by the "noocytes": a mildly retarded teenage girl in New York, a pair of identical twins, and Vergil Ulam's mother in southern California. No common basis for their exception is provided or even hinted at, nor any information on how many more such survivors there may be. The role of the three Californians is especially mystifying. They wander around the countryside for a while and eventually disappear into the biological Pandemonium of LA, having accomplished nothing for themselves or the story line. They do provide the author with a way to show the reader the changes the noocytes have wrought, but this seems redundant since the girl in New York plays the same role, and in any case it could have been done without raising so many unanswered questions and loose ends. An author may be forgiven for becoming too fond of his characters, but the editor should have required that these characters either advance the story or be removed.

Despite these problems, Blood Music is generally well-written, and quite engrossing. It scores very high on imagination and intelligence, and well deserves its Hugo nomination. Greg Bear stands as proof that a writer who is willing to work at it needn't be a scientist to write top-notch, high-science-content, hard sf. (Eon's jacket copy notwithstanding, Mr. Bear was an English major.)

* Okay, since you insist. (1) In Chapter 1, Ulam takes glass tubes out of an ultracentrifuge. To the best of my knowledge, nobody uses glass tubes, only fused quartz or various kinds of plastic, in ultracentrifuges; glass breaks too easily. (2) Both times he uses the word "radionuclides" he spells it "radionucleides." This could of course be a printer's error, and, to be fair, I should mention that some biochemists of my acquaintance pronounce it the way Mr. Bear spells it. (2-1/2) The acronym MAB (for Medically Applied Biochip) is a poor choice, since to biochemists and molecular biologists, it already stands for monoclonal antibody. Look, I told you they were trivial.

BRIDGE OF BIRDS by Barry Hughart
reviewed by Barry Gehm

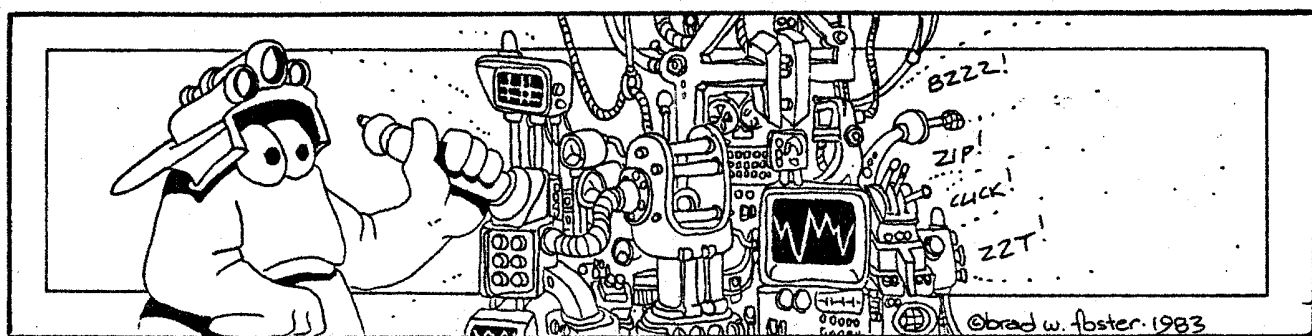
Bridge of Birds is an amazing piece of work.

Its subtitle, "A Novel of an Ancient China That Never Was," describes it accurately enough, if a little coyly, but don't be put off. This is fantasy, all right, but don't scorn it because it comes from the wrong side of the racks, there next to the D&D adventures, Buckets of Gor, and eighteen different titles involving unicorns or dragons. Similarly, don't let the Chinese setting start you thinking of monks engaged in inscrutable philosophical wrangling punctuated by kick-boxing. Bridge of Birds is as delicious, satisfying and solidly real as a moo-shu pork dinner.

The protagonist, a farm boy whose real name is Lu Yu, but whom everyone calls Number Ten Ox, is sent to Peking to find and hire a great scholar who will be able to discover a way to cure the children of his village, who have been accidentally poisoned. The only one he can afford is Li Kao, who has a brilliant mind but a slight flaw in his character: he prefers the life of a thief, confidence man and drunkard to that of a venerable sage. Li Kao's unorthodox methods lead him and Number Ten Ox into a series of picaresque adventures involving ghosts, gods, and ginseng. In pursuit of their goal they gain and lose several fortunes, climb into and fall out of a number of windows, and are sentenced to death at least three times. They meet some colorful people along the way, including the Old Man of the Mountain, Cut-Off-Their-Balls Wang, the most expensive woman in the world, and a literally heartless villain.

Bridge of Birds is hilarious but serious, moving but not mawkish. The characters are vivid and memorable, and, though I can't speak for historical details (which Mr. Hughart hints ought not to be taken too seriously), the feel of the T'ang dynasty Chinese background is exactly right, bespeaking considerable study and research. If I were forced to make some criticism of the book, I might say that the series of near-miss antidotes that Li Kao and Number Ten Ox brought back to the village verged on becoming repetitious, or that I found the idea of mistaking a giant invisible spider for a giant invisible hand a little implausible, or that I had difficulty believing that the rocket-powered bamboo helicopter (!) could stay aloft as long as it did. Well, perfection is hard to come by in this world. If Mr. Hughart can come this close to it regularly, his future as a storyteller seems assured.

This book richly deserves a Hugo nomination, though I fear it may be ineligible since it was published in hardcover in 1984, apparently not getting much attention at the time. (The paperback is published by Del Rey Books, which goes some way toward expiating the shameful matter of Return to Oz, referred to in the last issue.)



A LITTLE LITERARY TIME TRAVEL

by Bill Stoddard

One of the long-standing customs of American publishers used to be the production of series of books for adolescents. Practically every genre of fiction for adults (except for pornography) has had at least one or two such series associated with it. For technically oriented readers, the sort who grow up to read hard sf and engineering fiction, the most well-known series were the Tom Swift books, originally published between the first and second World Wars, and the Tom Swift Jr. books, published after World War II; "Tom Swift" is the name everyone thinks of, as ready on everyone's lips as "Nancy Drew". But there was at least one other such series, which I grew up reading: The Rick Brant books.

Some months ago I happened to mention them while talking with Jamie Hanrahan, and discovered that he also remembered reading them. This made me curious to look at them again, and the next time I was at my mother's house I looked for them and brought them home with me, wanting to find how they stood up to an adult reading. I remembered them as having been more enjoyable than the Tom Swift Jr. books, and I was curious to learn why.

As it turned out, I found them surprisingly enjoyable. No one would call books of this sort "literature", but even within the sphere of pure entertainment there are better and worse forms. The Rick Brant books were one of the better forms.

One of the things that makes them so is the relative plausibility of the characters. Tom Swift, Jr., at age 18, is one of the world's greatest inventors and scientists. Rick Brant, a year or so younger, is bright, technically skilled, and enterprising enough to have bought his own small plane (a Piper Cub) and worked out a way to make it pay for itself, but he acts as technical assistant to the scientists in the series. His friend Donald Scott, an ex-marine who enlisted underage (making him still young enough for the friendship to be plausible), has real combat experience and is handy with tools, but is also no superman. These kids would fit comfortably into a Heinlein juvenile. And the young female characters, Rick's sister Barbara and, in some later books, her friend Jan Miller, are treated with much less condescension than the years the books were published (1947 through the '60s) would suggest. Jan Miller is shown as both scientifically educated and sometimes philosophical, not as empty-headed and dependent.

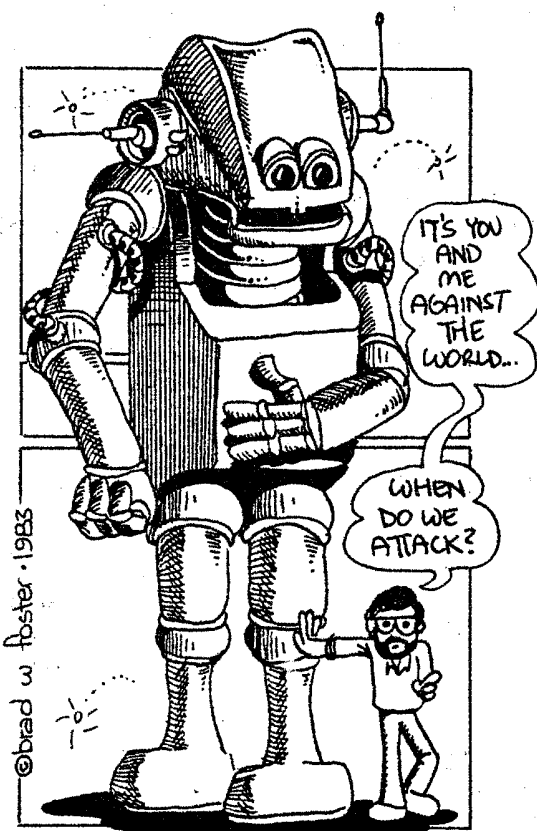
The adult characters are fairly well-drawn, too. They have a somewhat improbably wide range of expertise between them, but many of the novels give at least some feeling of genuine scientific investigation going on. Whoever the authors were who wrote as "John Blaine" for Grosset and Dunlap, some of them seem to have been in real scientific or technical facilities at some time in their lives.

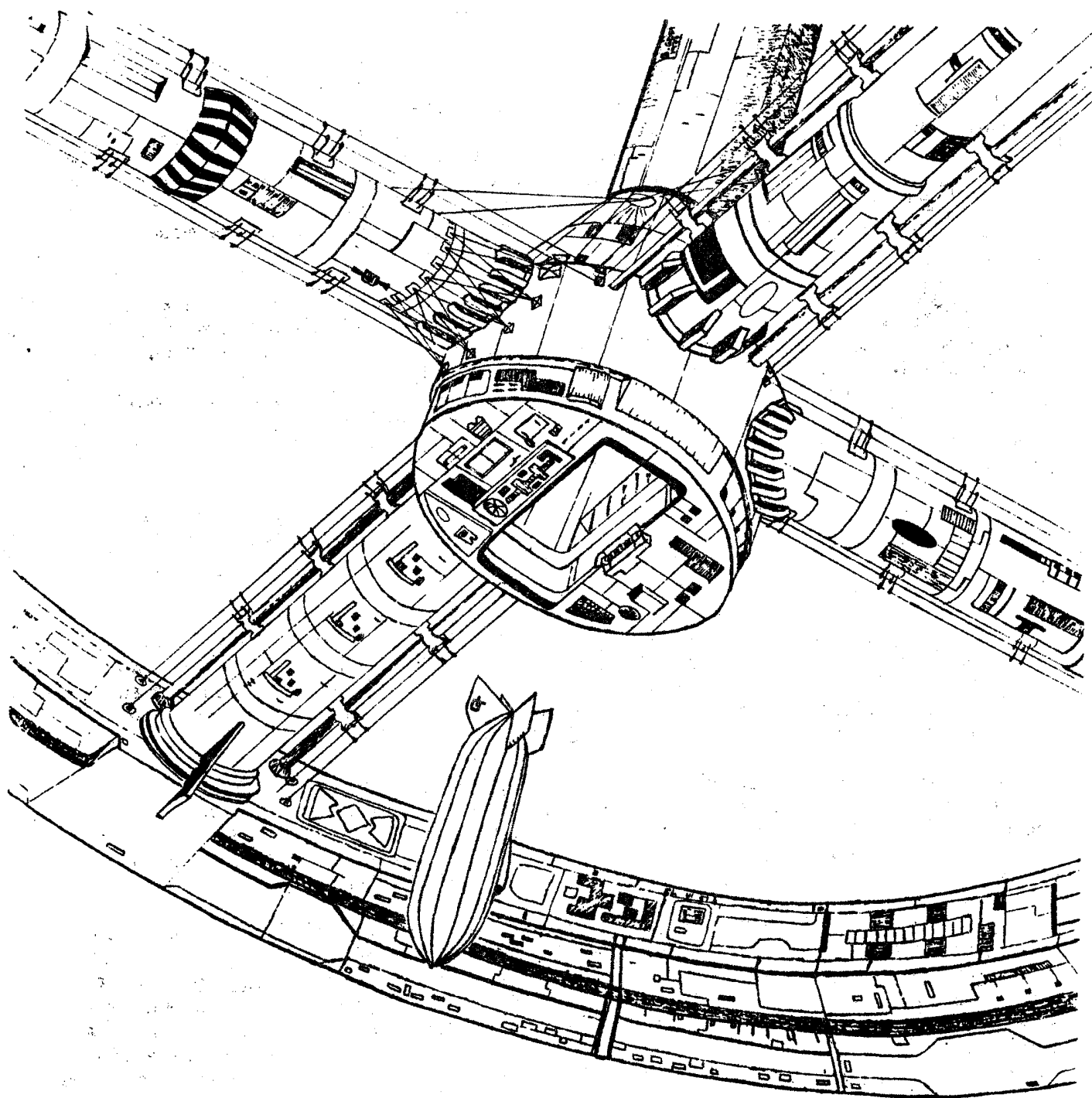
Their projects develop interestingly over the course of the novels. In the first of the series, The Rocket's Shadow, they are working on launching a privately financed moon rocket propelled by atomic fuel. (Doesn't the word "atomic" have a pleasantly archaic flavor now, when we all say "nuclear"?) A later novel, The Electronic Mind Reader, portrays a device that can temporarily erase a subject's memory from a distance if the subject's EEG is available. The novel specifies that the device's workings are not well understood and that it was probably discovered

accidentally. The level of theoretical and technological breakthrough has fallen significantly in between. Even the first novel was far below the worldshaking level of Tom Swift, Jr.'s inventions, but the later ones are made plausible by their technology's very limitations.

The historical settings of the novels date themselves in a number of ways. In the earlier ones, World War II is in the recent past. In the later ones, the United States is preoccupied with space travel and enemy agents, and its aid is welcomed freely by most foreign countries. An agency called JANIG (Joint Army-Navy Intelligence Group) is portrayed as unequivocally heroic. The personnel of Spindrift Island (the research organization directed by Rick's father) frequently take on government assignments without qualms of conscience. A novel written now would hardly be so sanguine.

Despite this, the Rick Brant series holds up surprisingly well. I read through all of my dozen books without getting bored or offended; at worst, I was amused at points that the intervening decades have made questionable. And I can see well that these books could help nurture an enthusiasm for technology in their readers, without cultivating unrealistic fantasies about it. A series of books could do a lot worse. If this kind of thing isn't being produced now, it's our loss; such things as the popularity of computers show that the market for juvenile techie fiction hasn't gone away.





WATCH THE SKIES

AN INTRODUCTION

by Barry Gehm

It's not my fault. I wasn't even in the same state when it happened, and I have witnesses to prove it. My spies, however, were there. (My spies are everywhere.) They tell me it all started at the General Technics meeting at LAcon. The topic under discussion was, as usual, how GT could ~~show/off~~ attract attention to itself and gain some new members, not to mention putting a little life back into the old ones. Various proposals, of varying degrees of insanity, were made. Undoubtedly the Great Tinkertoy Project was rehashed.

And then, someone mentioned blimps. (My spies claim it was Hugh Daniel, although I'd hate to hang a man on such flimsy evidence). "Why don't we build a remote-controlled blimp and fly it around in the Worldcon hotel atrium?" was the gist of the idea. Jeff Duntemann, former editor of Pyro and GT's resident philanthropist, reportedly offered to buy the helium for anyone who would build a blimp. (If you want to take him up on this, check with Jeff first. My spies are everywhere, but they're not very good.) Several people announced their intentions of flying mini-airships at Confederation.

I first heard about it a couple of weeks later, at a berserker held in Ann Arbor, MI, at Lee Hart's house. I was pretty skeptical, but at Donna and Tullio Proni's New Year's party ("Ishercon") a very crude prototype was constructed. I still didn't think anything would come of it, but I had not reckoned with Tullio's ~~insane/stubbornness~~ tenacity. As you will see in his accompanying article, Tullio and Donna have made considerable progress, and they should definitely be flying a blimp at Confederation. Tom Snoblen, having assisted Tullio with radio control, was reported to be working on his own blimp, and Tom Johannsen showed up at the last Ishercon with the skeleton of a balsa-wood zeppelin. Rumors have it that some techies out west will also be bringing dirigibles to Dixie.

All this seemed like an obvious topic for Pyro to cover and I decided to ~~brownbag~~ persuade some people to write articles on the subject. The following include a consideration of the theory of dirigible design by Sam Paris, Tullio's more practical account of actual construction, and, by me, a comparison of the various possible lifting gases explaining why helium is preferred.

But first, a little terminology. There are a number of terms for this type of aircraft. Any craft that gets its lift from being less dense than air is called a lighter-than-air craft (LTA). If it drifts with the wind, it's a balloon; if it's motorized so you can make it go where you want, it's a dirigible, also known as an airship. Airships are divided into rigid and non-rigid depending on whether or not they keep their shape when not inflated. (There's also an intermediate category called semi-rigid.) A blimp (as in Goodyear and Fuji) is a non-rigid airship. The best-known type of rigid airship was the zeppelin, named after the German general who designed them. The Hindenburg was a zeppelin. As far as I know, there are no rigid airships in service anywhere in the world. A handful of blimps still fly, mostly for advertising purposes. The day of the dirigible seems to be over, but some of us believe that they will rise again.

So watch the skies. Especially if you're at Confederation.

SEE SPOT FLOAT

A DIRIGIBLE DESIGN PRIMER

by Sam Paris

We apprentice dirigible engineers need some numbers to play with, if we are to build blimps that actually fly, or even if we just wish to wave our hands with authority while talking about building blimps that might fly someday. The most important number is how much weight a given quantity of gas will lift.

The only two gases worth talking about are hydrogen and helium (see Barry's article on lifting gases). Hydrogen is a slightly better lifting gas than helium, but if you thought con committees got upset about a few He-Ne lasers, wait until you tell them you want to deploy half a dozen flying firebombs in the con hotel.

The buoyancy of any material can be found by subtracting the weight of a given volume of that material from the weight of the same volume of whatever you plan to float it in. Those of you who remember your high school chemistry may recall that one mole of helium weighs 4 grams and one mole of hydrogen weighs 2 grams. For air, a mixture of gases, we can multiply the percentage of each gas times its weight per mole. Air is about 78% nitrogen (28 g/mole), 21% oxygen (32 g/mole) and 1% heavier stuff like argon and carbon dioxide. It works out to about 29 g/mole. So, one mole of helium will lift 25 grams and one mole of hydrogen will lift 27 grams, only about an 8% difference.

(For those of you who don't remember your high school chemistry, a mole is a unit that chemists and physicists like to use because it always contains the same number of molecules no matter what substance you are talking about. The weight of a mole is always the molecular weight times 1 gram, and the number of molecules is 6.02×10^{23} .)

Now all we need to know is how many moles of gas we need to fill a decent sized gasbag, say about one cubic meter (1000 liters). At Standard Temperature and Pressure (STP), which is 273 Kelvins (32°F) and one atmosphere, one mole of an "ideal" gas occupies 22.4 liters. Helium and air are close enough to ideal for our purposes, but an Atlanta hotel in August will not be at STP.

What will the temperature and pressure be? Exact conditions will depend on the weather, but we can try for an estimate. Fooling about with maps and Strahler's Physical Geography gives me 977 millibars for the average pressure in Atlanta in August. One standard atmosphere is 1013.2 millibars (I would have made it 1000, but I wasn't consulted). They tell me civilization has spread below the Mason-Dixon line, so the hotel should be air-conditioned. I think 80°F should be a reasonable upper limit on the temperature. How many moles will it take to fill 1 cubic meter under these conditions?

The ideal gas law is:

$$\text{PRESSURE} \times \text{VOLUME} = \text{NUMBER OF MOLES} \times \text{GAS CONSTANT} \times \text{TEMPERATURE}$$

$$PV = nRT \quad (T \text{ has to be measured on an absolute scale, like Kelvin.})$$

The volume and the gas constant are fixed, so let's get them on the same side of the equation:

$$\frac{P}{nT} = \frac{R}{V}$$

Which leads to:

$$\frac{P_1}{n_1 T_1} = \frac{P_2}{n_2 T_2}$$

Or:

$$\frac{P_2 n_1 T_1}{P_1 T_1} = n_2$$

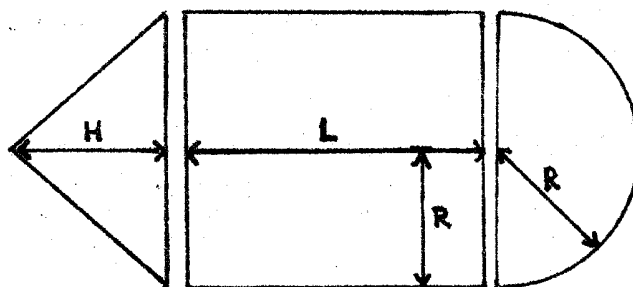
Finally we can plug and chug. We'll let the subscript-1 values be our STP figures and the subscript-2 values will be Atlanta in August. 80°F (T₂) is 303 Kelvins and n₁ is 1000 liters divided by 22.4 liters/mole = 44.6 moles. The number of moles to fill the same volume under our estimated conditions is then

$$\frac{(977)(44.6)(273)}{(303)(1013.2)} = 38.7 \text{ moles.}$$

So, at 25 grams of lift per mole, a cubic meter of helium can lift about 970 grams, minus the weight of the gasbag. For you devotees of hokey religions and ancient measuring systems, that's 0.97 oz. per cubic foot.

To get some feeling for this number, I weighed some things that might go into a dirigible. Duracell batteries weigh in at 130 grams for D cells, 64 grams for C cells, and 45 grams for 9-volt transistor batteries. Various hobby motors ranged from 20 to 65 grams (incidentally, a 9-volt Duracell drove the largest motor with a 6 inch propeller (18 grams) for 15 minutes before a noticeable drop in speed occurred.) 8-pin DIP IC's weigh 2 grams each. One mil thick polyethylene sheeting weighs about 25 grams per square meter, with thicker sheets proportionally heavier.

To approximate the volume of a blimp-shaped gas bag I put together a hemisphere, a cylinder and a cone.



The volume and surface area formulae are:

Sphere $V = \frac{4}{3}\pi R^3$ $A = 4\pi R^2$

Cylinder $V = \pi R^2 L$ $A = 2\pi R L$ (lateral surface only)

Cone $V = \frac{1}{3}\pi R^2 H$ $A = \pi R \sqrt{(R^2 + H^2)}$ (excluding base)

If we let $R = .5$ m, $L = 1$ m, and $H = .5$ m, we have a 2 by 1 meter blimp. A bit unwieldy, but these were the dimensions talked about in L.A. I get about 1.2 cubic meters for the volume of this behemoth, providing a lift of slightly less than 1150 grams (a little more than 2.5 lb.). The total surface area is about 5.8 square meters, so a gasbag of 2 mil polyethylene, perfectly formed without pleats, overlap, etc., would weigh 290 grams. The payload drops to about 850 grams (a little less than 2 pounds). More realistic assumptions about bag construction lower it still more.

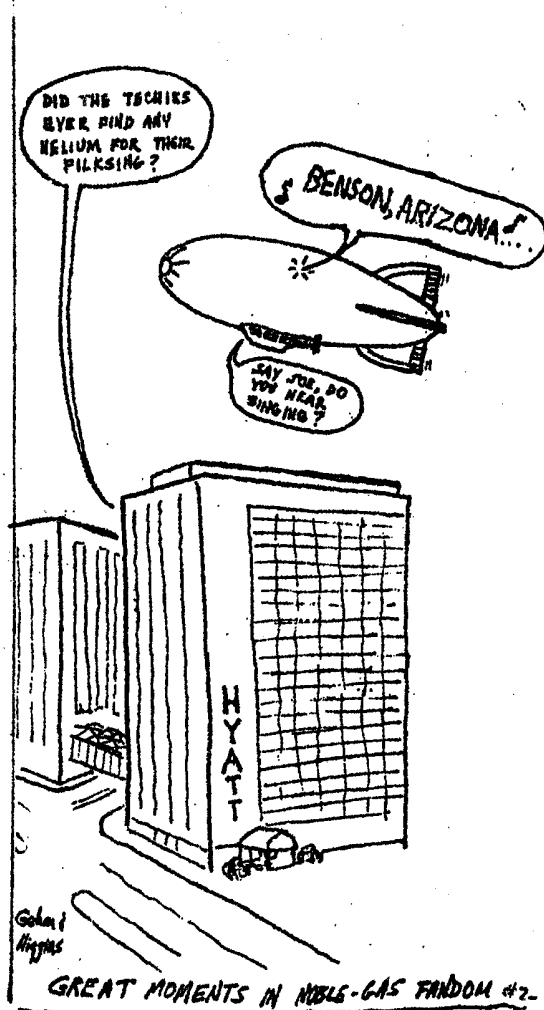
(See Tullio's article for more on the practical side of airship building.)

G

GENERAL
TECHNICS

ROOM 2081
HYATT

10:00 \pm 1:00
FRIDAY NIGHT



PARTY

BUOYANT SPIRITS

A SURVEY OF LIFTING GASES

by Barry Gehm

As more and more people joined the discussion on mini-airships at Lee's berserker, the suggestions would get more and more grandiose, and the imaginary dirigibles began to sprout lasers, rocket launchers and LED displays that would spell out messages to the astounded watchers below. Those of us who had been scribbling calculations on our napkins would then shout, "No, no! That's much too heavy! It takes a whole liter of helium just to lift one crummy gram!"

At that point, somebody who had just joined the conversation would say, "Isn't there anything that lifts better than helium? What about hydrogen? What about hot air? Why does it have to be helium?" This happened several times, and I'm afraid we rather snapped at the fifth person to ask that question. What I would like to do here is to answer that question fully and finally.

If you remember your high-school chemistry, this equation should look familiar:

$$PV = nRT$$

This is the famous ideal gas law, where P = pressure, V = volume, n = number of moles (don't panic, that's just a fancy way of talking about the number of gas molecules present without having to say "septillions" all the time), T = temperature, and R is a constant. If we want to talk about density, we can rearrange the equation to

$$n/V = P/RT$$

and then multiply both sides by the molecular weight. Since the molecular weight is the weight of one mole (in grams) and we multiply it by n , that gives us the weight of the gas, and when we divide by volume, we get density:

$$\frac{n (MW)}{V} = \text{density} = \frac{P (MW)}{R T}$$

This equation tells us the three ways we can get a gas of low density: low pressure, low molecular weight, or high temperature.

Low pressure is not very practical, since in flexible container (a balloon or bag) collapses as you lower the pressure inside below the pressure outside, and the volume decreases until the pressure (and so, density) are equalized. So your container must be strong and rigid, which means heavy, which means that the volume must be enormous to work. Considering low pressure does illustrate an important point, though. The limiting case of this approach is a complete vacuum, which has, of course, no weight at all. Its density is zero, and it represents the theoretical maximum of buoyant lift (until somebody actually invents Cavorite). The difference between the density of air (1.1845 grams/liter, at 25°C, (72°F) and one standard atmosphere pressure) and the density of vacuum (zero) is 1.1845 g/L, and no gas can produce more lift than this.

High temperatures are more practical than low pressures, but not as effective as low molecular weight. As you can see from the table below, helium provides three times as much lift as 250°F (136°C) air. The temperature of the air in hot air balloons varies, but this value was chosen as representative after talking to a balloon pilot. It is already somewhat above the temperature limits of polyethylene or PVC bags. (The actual lift in a balloon would be lower than calculated, since the surrounding air gets warm, lowering its density.) In order to get as much lift as helium provides, you would have to heat the air in your gasbag to over 3000°F (>1880°C), which presents certain difficulties. (Like supplying welder's goggles to the astounded watchers below.)

Of course, even ordinary hot-air balloon temperatures require an on-board source of controllable heat to maintain lift, and small balloons lose heat proportionally faster than large ones. The square-cube law does not favor small lighter-than-air craft generally, but especially not small hot-air balloons.

Low molecular weight provides the most practical approach. This means choosing a gas that has lighter molecules than air. The two most effective and popular are hydrogen and helium. Hydrogen achieves 93% of the theoretical maximum lift and helium 86%. Hydrogen's slight advantage in lift is offset by its flammability, however. While helium is the least reactive substance known and will not burn at all, hydrogen burns readily, even explosively, as the fate of the Hindenburg attests.

Then why did the Germans use hydrogen in their zeppelins? It is much less expensive and was more easily available to them. Hydrogen can be produced by the electrolysis of water (cheap), where as helium is obtained either by fractional distillation of liquid air (very expensive, as it is only present in trace amounts) or from certain natural gas wells (only moderately expensive, but virtually all these wells are in the United States). As a matter of fact, the Hindenburg was designed for use with helium, but the U.S. refused to sell any to Germany. It is interesting to speculate on how differently things might have worked out if we had sold them the helium. Lighter-than-air craft might still be in common use. Giant airships might today be floating serenely in our skies, and Neil Rest could be leading a bid to have a Worldcon aboard a luxury zeppelin. (Actually, the public response to the destruction of the Hindenburg is an early example of overreaction caused by media hype. As tragedies go it wasn't much: only 36 people killed out of about 100 on board. But it was filmed for the newsreels and photographed for the papers and recorded for the radio, giving it a kind of nationwide immediacy that must have been rare in the days before satellite TV news. Such are the vagaries of history.)

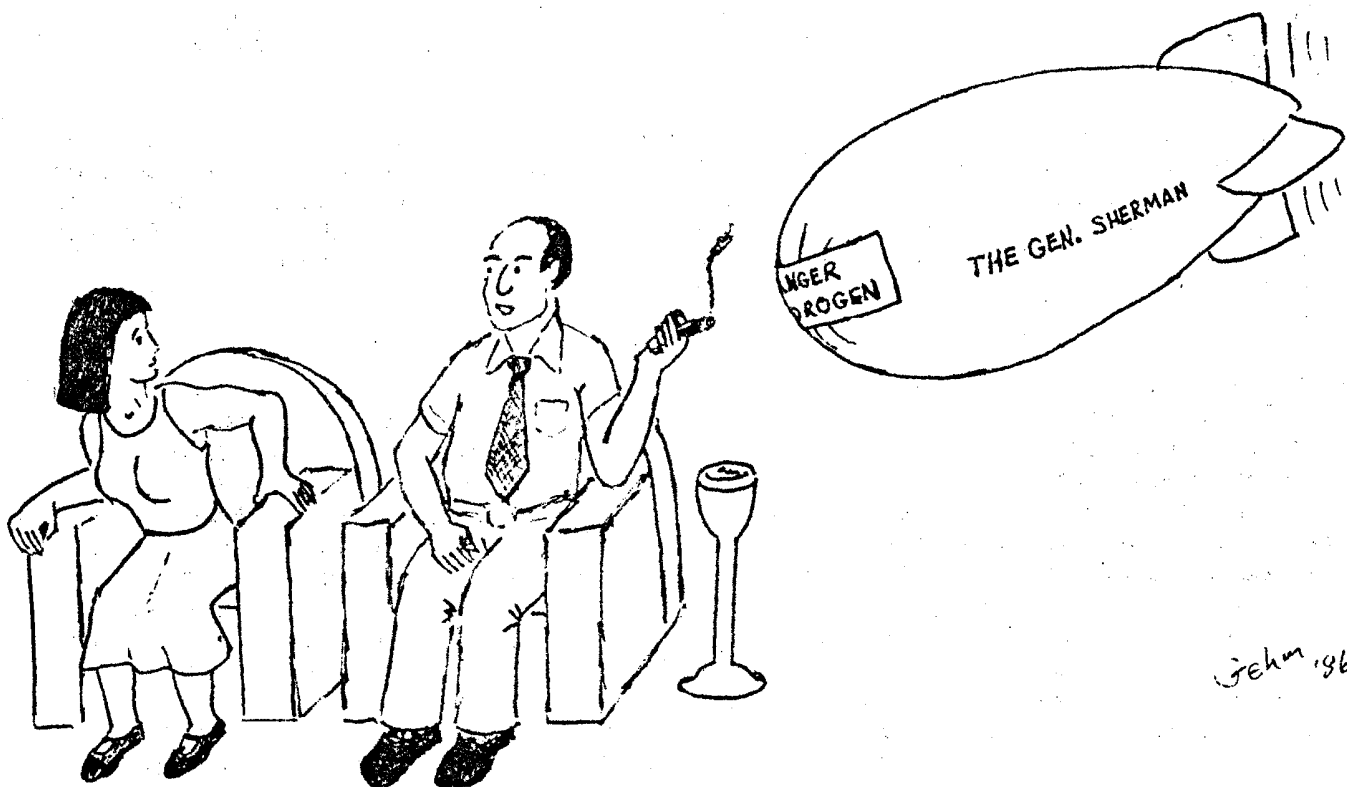
Somebody suggested live steam as a lifting gas. It combines the advantages of a hot gas with somewhat reduced molecular weight, but has several disadvantages of its own. Steam has a greater heat content than hot air, which means it takes more energy to produce and it causes far worse burns if it escapes onto flesh. Further, if it loses too much heat it turns back into water, which is much denser than air. If the heater fails, a bag of boiling hot water drops onto the astounded watchers below.

The table below lists all the intrinsically lighter-than-air gases, plus steam and hot air. For you non-metric types, one gram per liter is almost exactly the same as one ounce per cubic foot, and in round terms, the lift of helium is approximately 1 of either, which is convenient for thumbnail calculation. As you look at the lift column, keep in mind that less lift per unit volume means bigger bags, which means more weight in the structure of the ship and less real payload. As you can see, nothing comes close to hydrogen and helium. (Because lift increases faster than weight as you scale up, really big airships may be practical with less efficient lifting gases, but for a mini-dirigible you need all the lift you can get.) Hydrogen's only important advantage is its cheapness, but how much do we save if a hydrogen-filled blimp comes down on the lit cigarette of an astounded watcher below? Hydrogen may be cheap, but getting sued is expensive. (Also, the folks in Atlanta are mighty touchy about Yankees and fire, for some reason.)

And that, friends, is why it has to be helium.

LIFTING GAS	MOL.WT.	DENSITY g/L	LIFT g/L	COMMENTS
Vacuum	0	0	1.1845	requires rigid (=heavy) container
Hydrogen [H ₂]	2.016	0.0823	1.1022	flammable
Helium [He]	4.003	0.1634	1.0211	completely nonflammable
Steam(250°F) [H ₂ O]	18.015	0.5384	0.6461	gets <u>much</u> denser if it cools
Methane [CH ₄]	16.04	0.6568	0.5277	flammable (= natural gas)
Ammonia [NH ₃]	17.03	0.6998	0.4847	smelly and poisonous
Hydrogen Fluoride [HF]	20.01	0.816 *	0.368	corrosive and poisonous
Neon [Ne]	20.18	0.8246	0.3599	completely nonflammable
Hot Air(250°F)	29	0.863 *	0.322	requires heat-source
Acetylene [C ₂ H ₂]	26.04	1.0698	0.1147	flammable
Hydrogen Cyanide [HCN]	27.03	1.102 *	0.082	extremely poisonous
Nitrogen [N ₂]	28.01	1.1457	0.0388	harmless mostly harmless
Carbon Monoxide [CO]	28.01	1.1457	0.0388	poisonous
Ethylene [C ₂ H ₄]	28.05	1.1522	0.0322	flammable

All calculations are based on a pressure of 1 standard atmosphere and a temperature, except as noted, of 72°F (25°C). Values for gases marked with a * were calculated by the ideal gas equation without van der Waals' correction and may be inaccurate by up to 1%.



My insurance company? New England Life, of course. Why?

UP SHIP!

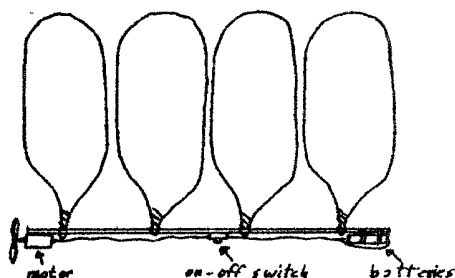
PROGRESS REPORT ON DIRIGIBLE CONSTRUCTION by Tullio Proni

This report covers the work done on the Confederation lighter-than-air craft at the House of Isher from January 1985 to May 1986. Almost all the work was done by me and my wife, Donna, although we received valuable suggestions from other GT members, most notably Bill Higgins and Barry Gehm.

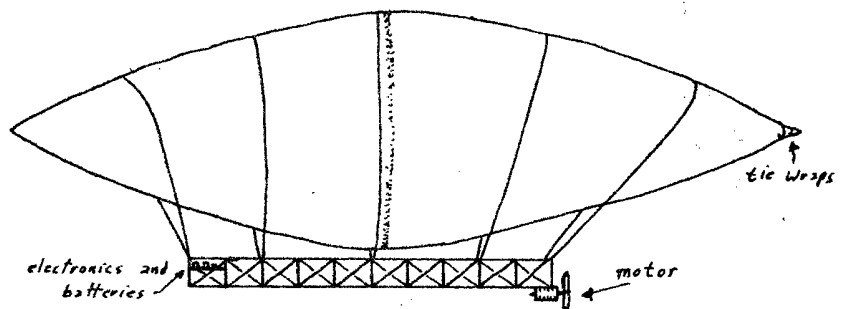
As I believe that the first step in getting a project of this kind "off the ground" is to get something airborne, most of the work concerns the construction of gas bags and understructures. Some work has also been done on the propulsion system and steering, and Tom Snoblen has provided great assistance in the area of radio control. It is hoped that this article will offer some insights into the problems of mini-dirigible construction, provide helpful guidance to any other techies interested in blimp-building, and generally stimulate interest and discussion. Constructive suggestions and offers of help are also welcome here at Isher.

ISHERCRAFT #1

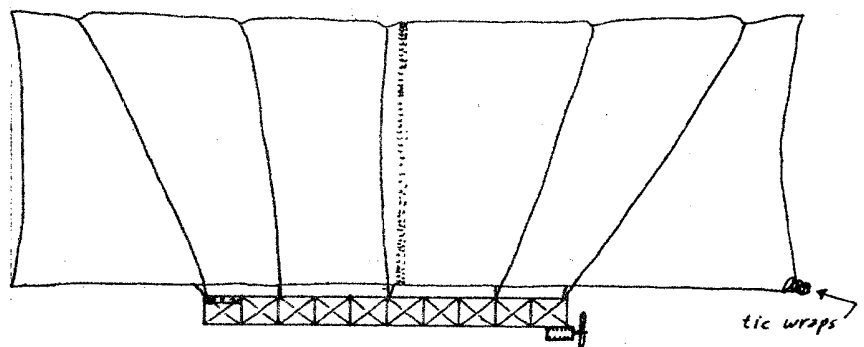
This awkward-looking craft (see Fig. 1) was built on the spur of the moment using four "kitchen size" (13 gal.) garbage bags. The bags were filled with helium, then tied off using masking tape, which was also used to hold them to a 5/16" thick, 31" long balsa wood beam. A motor and propeller were taped to one end of the beam and 4 internal cells from a disassembled 9v battery at the other. A switch controlled the motor.



ISHERCRAFT I



ISHERCRAFT II



ISHERCRAFT III

1'

FIGURE 1

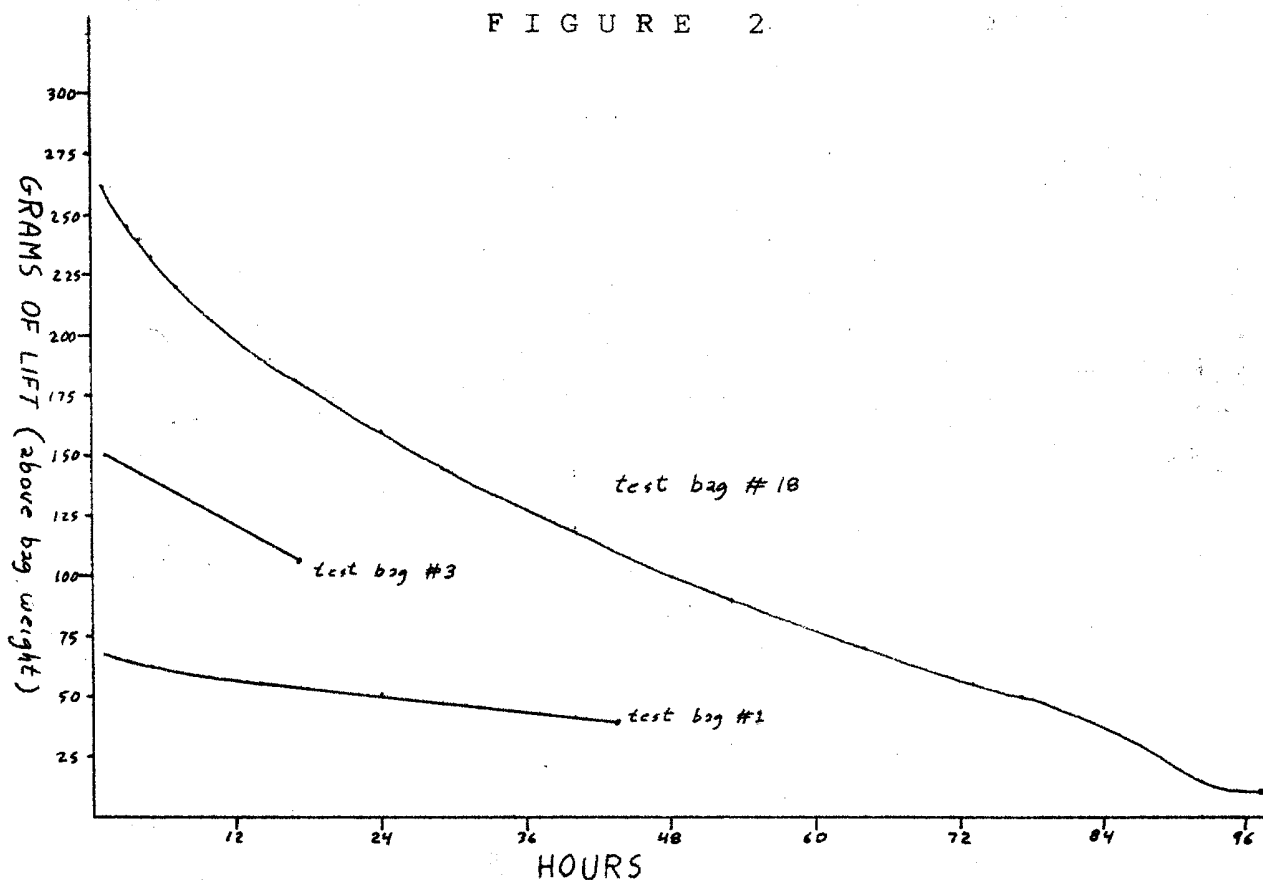
The first propeller was hand-carved from a piece of balsa wood by Todd Johnson and was about 3" long. Later we replaced it with a plastic propeller bought at a hobby store. Very large plastic propellers, normally used on rubber-band powered model airplanes, are available at most hobby stores. The propeller used on the I #1 was only 4" long, but was able to propel the craft at a speed of 2-4 mph. When tied with about 4' of string to a rod fixed to a chandelier, the craft would circle the room.

This craft had several problems. First, bags sealed with masking tape could not be refilled, and they leaked significantly. As the day progressed, several 12" toy balloons had to be added to keep the craft afloat. Second, the lift was barely adequate. The payload excluding the bags was only 82 grams plus at most 5 g of ballast. Third, the motor was power-hungry, drawing 350 mA at 6v, and it would stall out at 4v. At that rate of drain the battery lasted less than 15 minutes.

TEST BAG EXPERIMENTS

Since Ishercraft #1 lost buoyancy rather rapidly, we experimented to determine how rapidly leakage occurred, and what could be done to control it. One of our first ideas was to try heat-sealing the bags. We tried a variety of methods, from nichrome wire to soldering irons. The quickest and most effective proved to be a household clothes-pressing iron set on low heat. The iron was briefly applied to the bag with the two sections to be joined overlapping by at least 1". This was repeated along the length of the joint until all but 1" of the mouth of the bag had been sealed. This opening would be used to fill the bag with helium after it had been checked for leaks. Initially we checked the joint's ability to hold a little water placed in the bag. A more effective method was to fill the bag with air from a hair dryer, tie it closed, and check it visually the next day.

FIGURE 2



Test bag #1: When we had a bag that passed these tests we emptied it of air and tested it with helium. Care had to be taken not to over-fill the bag, which would strain the joint and produce leaks. The bag weighed 35 g, was pillow-shaped and approximately 2.5'x3'x1' when full. Weights were placed in a paper cup hanging from the bag and removed one by one as the bag lost buoyancy.

The results of the test are plotted in Fig. 2. It should be noted that the plots show not total lift, but lift above the weight of the bag, string and cup. The results were most encouraging, showing a loss of only 17 g of lift in 24 hr. It should be noted that the helium in the bag is under very little pressure, unlike that in an elastic rubber balloon.

Test bags #2 through #15: In order to improve the volume-to-weight ratio and the total lift, we switched to a design comprising two garbage bags joined at the mouths. One bag was placed inside the other to form a double bag; the two bags were then heat-sealed together around the mouths, except for a 1" opening for filling the gasbag. The inner bag was then pulled out, producing a construct of two bags (one inside out) sealed by a flanged joint at their mouths. The small opening was twist-tied shut after filling the bags with helium.

Leak test results for a typical bag in this series (#3) are shown in figure 2. The rate of buoyancy loss was disappointing: more than twice than of TB #1. Using the water test we discovered that leaks had formed around the joint between the bags, even though it had checked out OK before filling. The problem was thus the fragility of the heat-sealed seam. In the next 12 bags we attempted unsuccessfully to solve this problem, using wider overlaps of material, different iron temperature, and different brands and thicknesses of bags. None of these resulted in any significant improvement, and thicker bags simply cut lift.

We did fly Ishercraft #2 with this type of bag, however, and experimented with sculpting the bags into cigar shapes more nearly resembling traditional airships by ironing together an arc of material at the ends of the gasbag, but the cost in terms of lift was surprisingly large. Ultimately we went to a design in which two bags were placed mouth to mouth and taped together, then both pulled inside-out through a small hole cut in the bottom of one of the bags. The seam was taped again and the small hole used for filling the bag, then tied off. This gave leakage rates slightly better than the best heat-sealed bags (see test bag #18, fig. 2) and was much easier to do.

UNDERSTRUCTURE

The understructure of the Ishercraft #1 was too short for use with the longer bags. Having all the weight suspended in the middle caused the bags to buckle as they lost pressure. A new understructure, a trusswork of thin pieces of balsa held together with glue, was constructed. The dimensions and amount of bracing were chosen arbitrarily, but proved adequate. Although individual braces sometimes broke during collisions, rough handling, etc., the damage was easily repaired, and the structure was sturdy enough to mount a motor, batteries and electronics. We used a Radio Shack motor designed to be powered by solar cells but powered it with two cells from a disassembled 9v battery (3v). It drew 120 mA from this supply but could operate on less. We experimented with remote on-off control using a flashlight to operate a photocell controlling the motor; this could be made to work but was not practical.

ISHERCRAFT #2 AND #3

Ishercraft #2 and #3 were built for Capricon 5 (Feb. 1985) and used double bags and the understructure described above. The understructure was attached to the bag by five loops of string passed over the bag and tied to the trusswork. I #2 with a sculpted cigar-shaped gasbag, was launched on the first day of the convention and achieved a speed of 4 mph carrying 30 g of ballast but was retired after only 2 hrs of flight because of leakage. I #3 took off the next morning with over 100 g of ballast and a much lower leak rate. Its obvious origins led to its being nicknamed the Hindenburg. Perhaps this is why it impaled itself on a chandelier, whose bulbs quickly melted through the plastic, producing a dramatic, albeit flameless, crash. A more likely cause was the ventilation system, whose breezes easily overwhelmed the power of the propeller if the airship approached a vent. These pose a serious hazard to any future dirigibles as well, and their locations should be noted before attempting a free flight.

Except for such hazards to navigation, the craft flew quite straight and level for distances of up to 100 feet, remarkable considering there were no fins or other control surfaces. After the crash the damage was quickly repaired with masking tape before too much helium was lost, and the Hindenburg flew again, but on a tether. A thin thread attached to the front of the understructure could be used to cause the craft to fly in circles, or follow a person holding the thread around the con.

In general, the Ishercraft #3 was quite successful, demonstrating that airships at conventions are feasible and can be maneuvered down hallways and even into elevators, although ventilation currents are a hazard. However, I #3 was not a true dirigible since it lacked any internal directional control. As a step in developing this control, Ishercraft #4 was built.

ISHERCRAFT #4

For this craft we added outriggers to the understructure from I #3 and mounted a propeller and motor on each outrigger (fig. 3). The motors were of the same type used on I #3 but the propeller size was increased to 10". We hope to be able to steer the craft by reversing the motors. For instance, running the starboard motor in the forward direction and the port motor in reverse would cause the craft to turn to the left. The motors were powered and operated from a control unit bearing the battery and two variable resistors to control motor speed. This unit was connected to the craft by light wires and was intended to be hand-held, but the wires caught on furniture and other obstruction when flying indoors. Eventually we let the control unit hang from the understructure after setting the resistors and allowed the craft to fly free. It could fly in smooth arcs that would have been circles if enough clear maneuvering room had been available, and could even rotate in its own length if the motor speeds were carefully matched. This approach offers considerable promise for speed and direction control with radio-controlled motors. If a remote-control system capable of independently controlling three motors can be obtained, a third, vertically oriented motor can be mounted for altitude control.

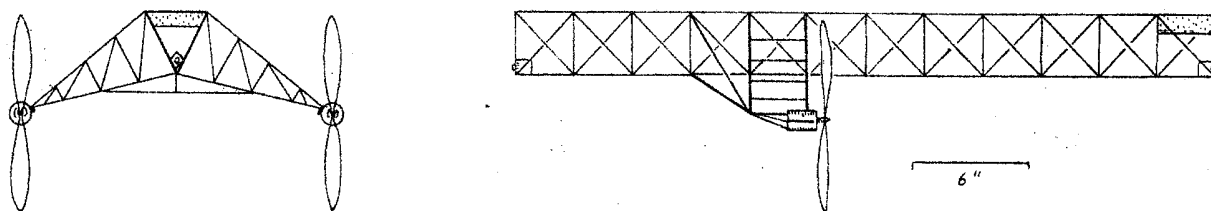


FIGURE 3

ISHERCRAFT #5

This craft was built and flown at Windycon '85. It was the same as I #4 except that a remote control unit built by Tom Snoblen was added to the understructure at the convention. In spite of the rather ad hoc nature of its construction this proved to be the most successful craft to date. One reason was the large six-story lobby in the hotel, which was almost ideal for flying. The craft was ballasted to float at the 3-4 story level, allowing it room to rise and fall due to slight air currents without hitting ceiling or floor.

The radio control, which was built from scratch, did have the not-so-minor flaw of lacking reverse. This resulted in the craft eventually "landing" in a potted tree and the hotel management, after rescuing the craft, put an end to the night's flight. Even lacking reverse the craft was still fairly maneuverable, being able to turn a 50-60' circle. Some degree of altitude control was also achieved by ballasting the craft so that its nose pointed downward. This caused it to descend when moving forward; when the motor was shut off it would rise.

ISHERCRAFT #6

This craft differed radically from previous ones in that its primary motors were mounted on its sides rather than hanging underneath. The outriggers bearing the motors were attached to flat balsawood sheets mounted onto an aluminum rod running transversely through the center of the gasbag, which was larger than those used previously. Large washers were used to seal the bag where the rod passed through, which worked fairly well. A small understructure held an improved radio control which now included reverse.

The hotel at Conclave, where this craft was first tested, was not blimp-friendly. The ceiling over the pool, which was the only place large enough to fly in, was only two stories high, and covered with large deadly fans producing vicious downdrafts. If that was not enough, we discovered that the battery/wire combination used did not provide enough power to the motors, and the larger bag produced greater drag, resulting in very low speeds. Adding the understructure and motors used in I #4-5 increased the speed only slightly, although there were now six motors on the craft. This appeared quite impressive but achieved a speed of less than 2 mph (approximately half that of I #5). Disasters were avoided only by keeping the craft tethered.

RECENT DEVELOPMENTS

We are currently making changes to increase the power of the motors. Other areas requiring work include altitude control and the addition of fins. Also, the tendency of the bags to sag due to the weight of the motors, etc., may necessitate a longitudinal keel, making the craft semi-rigid.

CONCLUSION

This report has detailed the activities here at the House of Isher thus far. We hope the information contained herein will be of help to anyone trying to build airships of their own, and we are eager to hear of the activities of others. Let's make a good showing in Atlanta.

["Why do you call it 'Pyrotechnics'?" people ask. "Are you writing about how to start fires?" Well, no, I explain, the subscription list includes people interested in all kinds of technology, from particle accelerators and FTL drives to organic gardening. So it's about time we ran a nice down-to-earth story about one area of "technic" that's near and dear to everyone's hearts (or at least stomachs) -- cooking! It can even involve fires, depending on what you run your stove on... --JEH]

CAP'N AL'S STUFFED DEEP DISH PIZZA RECIPE

by Al Duester

For utensils you gonna need:

- Clean smooth counter for rolling and kneading
- Deep dish pizza pan (14" - 16" internal diameter)
- Large bowl for crust
- Cutting board for finished pizza
- Various measuring things
- Mortal and pestle (or something) to crush dill seed
- Oven (but don't preheat it yet)

For the crust:

- Crush and grind 4 tsp. dill seed
- Mix with 1 cup hot water
- Add 1 package fast-rising yeast
- Add 1 tsp. sugar or honey
- Set the above aside, stirring occasionally 'til the mix foams a bit

- Sift 4 cups unbleached white flour (King Arthur brand) into a bowl
- Stir in 1 tsp salt
- Add the above yeast mix
- Add 1/3 cup olive oil

Stir the above stuff together. The final crust is dependent on the proper mixing of the dough at this point -- too much water can ruin the crust. Flour can be added during stirring, but you can't add it after starting kneading and get quite the right results. The mix should appear too dry while you are stirring in the bowl, but should just clump together with a little dry stuff left at the bottom of the bowl. On a clean and lightly floured counter, dump the contents out and start kneading. The dough should hold itself together after a minute of mashing it around. It should feel smooth and dry and not stick to your hands. If the dough is too dry, add water a few drops at a time. Add only enough to make the dough hold together (knead it a while after adding each few drops to see if it does). You have to knead until the dough is smooth and elastic, and then some. Take out your frustrations! The amount of time for proper kneading is about ten minutes. After kneading, put it in a lightly oiled and covered bowl in a warm place. I usually turn on the oven light, then turn on the oven for no longer than a minute to warm it up. Let the dough rise for about 45 minutes to an hour, 'til it's about doubled in volume.

Meanwhile, make the sauce. For a double size batch (two 15" deep dish pizzas with lots of sauce):

- 2 28-oz. cans Stop and Shop all-purpose pear tomatoes
- 2 6-oz. cans Hunts regular tomato paste
- 1 Tbsp sugar
- 1/2 tsp salt
- 3/4 tsp crushed Rosemary
- 2 tsp Durkee Italian Seasoning (mix of spices)

And, for filling for each pizza:

- 1 cup grated parmesan
- 2 lb mozzarella
- 1 lb provolone

While the dough is rising, mix the spices with 1 can of the crushed tomatoes. Boil it until the thickness is halfway between the crushed tomatoes and the tomato paste, stirring often. Add the other can of tomatoes and the cans of tomato paste. Cook until the mix just starts to boil again, then remove from heat. If you decide to make a half batch of sauce, boil half of the can of tomatoes first. The idea is to leave some of the tomatoes unsundered by long boiling.

By this time the dough should be risen. Remove it from the oven and divide it into two globs, 60% and 40% respectively. Turn on the oven and preheat to 425 F. Roll the larger portion out for the bottom crust, the smaller for the top. Apply the smallest film of oil to the pan, then put the lower crust in place. Fill it with the mozzarella and provolone and 1/2 cup of the grated parmesan. Cutting the mozzarella into 1/4"- to 3/8"- thick slices and filling between the square slices with triangle sections works well -- you want to leave as little air between the crusts as possible. (I recommend the mozzarella at Jack's as being the best in the Falmouth area for the price. You also get a discount if you purchase an entire block -- about enough for three pizzas.) [And if you're anywhere near the Los Angeles area, you'll find the best quality and prices on cheese at Trader Joe's. I guess those of you in the rest of the country are on your own... --JEH] Place the top crust in place and crimp over the edges. Wetting both crusts at the edges makes this work better. Pour the sauce over the top. Sprinkle 1/3 cup grated parmesan over the sauce.

Cook it in a preheated 425 degree F oven for 30 minutes, then reduce heat to 350 and cook another 15 minutes. You will have to poke holes in the upper crust after ten to fifteen minutes. If you don't, the bubbling will lift the crust and sauce up and that section will burn.

Let the pizza sit for five to ten minutes after you remove it from the oven. It can then be removed from the pan and cut on a cutting board. Cutting the pizza while in the cooking pan scores the pan and eventually makes it hard to cook the pizza without it sticking.

[And then be prepared to beat off the ravaging hordes with a large club! Repeated experiments have proven that the rumor of "free pizza" travels at trans-light speeds, particularly among fans at a convention. --JEH]

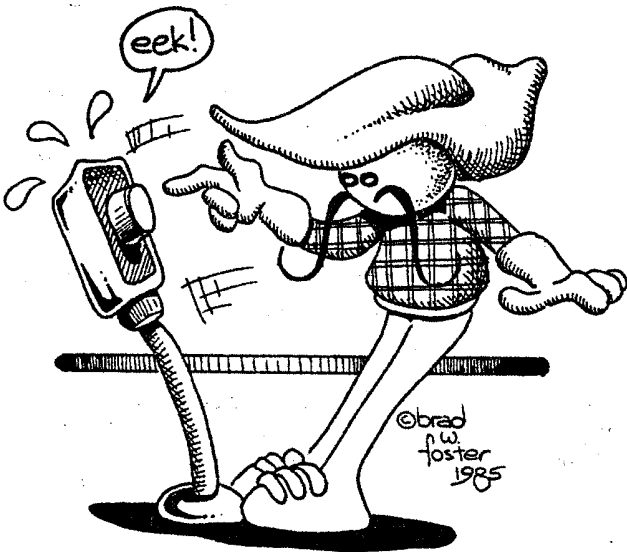
ZAPS! FROM THE BACKWOODS

de George Ewing WASWTE

OCH, AYE, CAP'N! WE KINNA STAND MOOCH MORE O' THIS!

At least two potentially good SF movies have been spoiled for me by the rock group, Queen. The first was Flash Gordon The Remake, where the soundtrack was so painfully loud I had to leave after the main title. Highlander, while not shown with as loud a track as either that epic or Toto's Dune, was still very uncomfortable. Any time the rock track drowns out the bagpipes in a 16th Century Scots battle, something's wrong. Anyway, this starts out as a promising fantasy movie about immortal warriors, but degenerates toward the end into a heavy-handed self parody of a heavy metal video, complete with stupid-ass lightning bolts and fireworks. Tarzan... how Mel Gibsen whisks... Tarzan screw lady cop... Tarzan hack it out with Gonad the Barbarian at second rate KISS concert... despite a good sex scene, a charming but all-too-brief cameo by Sean Connery as a wise master training a promising-but-naive apprentice warrior, and a few fairly decent swordfights, this isn't even up to the level of normal Skiffy.

Most of the problems with this film could have been fixed by confiscating most of the director's fireworks budget, and then using the money to hire a professional SF writer or even an experienced fan to fix up the dumb plot contradictions. The presence of the immortals is never adequately explained. They aren't introduced at a single point in history by gods or extraterrestrials; Connery's character has been around since 2,000 BC or so, but the hero was born in the 1500's. If they're a natural mutation, cropping up every so many thousand births, there ought to be many thousands more of them around today because of population growth. If none have been born in modern times, the reason isn't even hinted at. The big prize and the reason for all the off-with-his-head violence is really silly, unworthy of a good Lost in Space episode. Throwing Silver Hammers at the scientific problems of sword metallurgy and the physiology of indestructable warriors is pointless



in even a good fantasy where magic is allowed, so why bother for a silly rock video? A few sex and violence stills from this movie might make good wall posters or lurid paperback covers...

KLINGON TRIBBLES TAKE KANSAS BY STORM, LEAVE FANS LAUGHING!

Rock and Roll and fireworks, if used sparingly and with a sense of humor, don't automatically ruin an SF movie. Critters, as silly a bit of fannish crossover nonsense as I've seen in a long time, manages to be everything from a slapstick comedy and inside joke parody to a gripping and bloodthirsty drama at the same time. This is a crossover involving: A. Bounty hunters and imperial prison officials from something like the Lucasberger Starwarz/Jubba-the-Hut/Cantina univers, B. Vicious criminals inhabiting nasty, Gremlinoid, Klingon Tribble bodies, C. An updated version of that "meanwhile, on a small farm in Kansas" setting from a dozen bad UFO movies. There is lots of funny schtick, from an obscenity-spewing tribble dousing its terribly blaster-singed fur in a toilet, and lurking there for revenge, to an extremely horny teenage farmer's daughter's assault on a shy city-slicker boyfriend, to a great parody of the classic bowling alley riot in Son of the Blob. Having the slimeface alien bounty hunters masquerading as an obscure rock and roll singer, deputy sheriff, and preacher is nicely done in deadpan. The techie Little Brother, who is a cross between Cap'n Al as a child and Podkayne's sibling, Clarke, from the Heinlein novel, is first rate, like a young Ron Howard with a fistfull of Trinitro, Trichloro, N, 2, N, 4 -diethylazide-Polybathroom Fluoride. You can bet yer ass this kid knows how to make NI_3 , and went on to stronger stuff as soon as he got into sixth grade...

JOB OPENINGS NOW IN

CALIFORNIA!

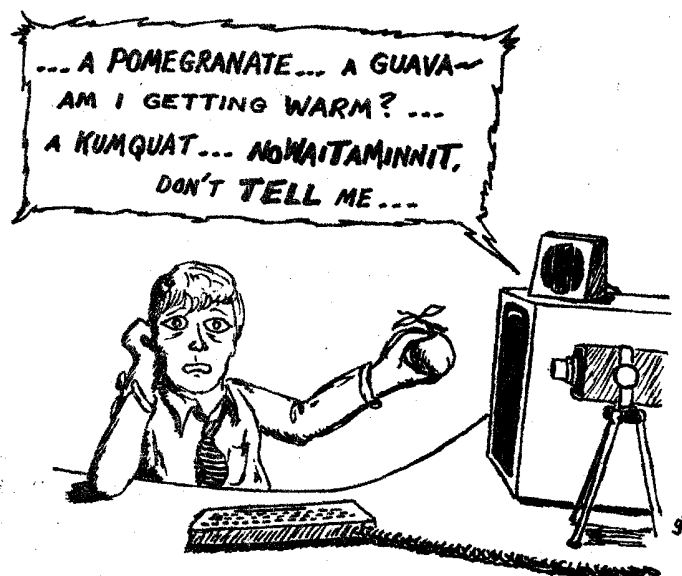
Tick-Tock-Tech, Inc., a Fortune 1350 company with a reputation for excellence in certain chosen markets, is hiring now in CALIFORNIA! Our plant is right on the beach! Lockers for all employees, four weeks paid vacation each year, 75-minute lunch period, lots of cute girls in the office staff, skiing and camping on weekends! The jobs involve doing something with electronics or computers or like that which is probably pretty interesting if you're into that stuff, which us here in the Personnel Dept. really aren't. Send a detailed resume with salary history (and, listen, goose it up a couple of \$K because we just got a big defense contract) to:

TICK-TOCK-TECH, INC.

Attn: Fred or Susie

One Growth Industry Plaza
Santo Volleyballo, CA 98156

EOE M/F/H/Short/Gay/Lesb/Veg/Jobr/Fat/Buddh.
Non-tobacco-smokers only, please.



WORK CONTINUES IN AI LABS ACROSS THE NATION
ON THE PROBLEM OF PEACH RECOGNITION.

ACK! MORE MOVIE REVIEWS

by Greg Ruffa

I mentioned last time the idea of a Dystopia Film Festival (with frequent intermissions so those who can't face the Future can visit our poisoned-candy counter). Certainly, Brazil needs to be on the program at a point when things need to lighten up a bit. It is not a comedy in the classical meaning of the term, i.e., a story in which the protagonist wins out. It is not even Monty Python in Oceania, though there is very much the same visual "feel" that Terry Gilliam brought to Time Bandits. This movie is comic only in the way that modern life is comic. Gilliam creates a Western world of the mid- to late-Twentieth Century that is not our world, but is very much like it, with its overblown, directionless bureaucracies, indiscriminate acts of violence, obsession with security, pointless applications and endless overlays of technology, and the general sense that Nobody Is In Charge Here. There are many funny things here, but it is not a funny movie. I found it interesting in its conception and would like to see it again, but it is disturbing as well, which doesn't give it much commercial potential in "this happy land" of ours.

We hear a lot about "special effects movies", but here's one that's about special effects (sort of). In F/X, an Australian effects master working in New York receives an unusual commission from the FBI: He is asked to fake a "hit" on a Mafia capo who is about to give evidence in court against his former colleagues, the idea being to divert any real hit men from their target until the trial. The scam is a success. The next thing our hero knows is that he is being sought by the police as the assassin, and the people who hired him are trying to kill him. The movie is very good at keeping you in doubt about what the real story is right to the penultimate minute. I was disappointed that the resolution of his tribulations with his ex-employers works out a little too well to be plausible, and the ending is straight out of Mission: Impossible. Still, it's a pretty fair thriller and well worth the two bucks I paid. This film wins my personal award for finding the Worst New Use For Crazy Glue.

Oh boy, another movie about robots, so, of course, I had to be there. Oh dear, another movie about cute robots... Actually, they're about as cute as anything designed for combat and armed with a kilowatt laser is likely to be. (Actually, Syd Mead had a hand in the design and they are well thought-out.) In Short Circuit, the robot in question receives one of the standard cinematic, quasi-magical transformations -- i.e., being struck by lightning -- and becomes self-aware (!). After a typically contrived set of circumstances which allows him to escape his builders, he gains a rapid education in the ways of the Real World, as seen on television, and comes to think of himself as alive. The woman who finds him eventually becomes enchanted by him and wants to keep him alive; his programmers want him back for study; and the military wants to blow him away. I won't go into the plot too much; the whole thing is intended to be a comedy. While it has some humorous bits, the writing and pacing are too poorly conceived for it to be successful as a comedy. The robot manages to seem more human by contrast because there is not a single believable human character in the film. Ultimately, the worst thing about it for me is that the real issue of how we would come to deal with self-aware machines, if and when they come to be, is totally brushed aside (what do I want from a summer movie?). I think a really good story about this idea would have both humorous and threatening aspects to it and a great deal of dramatic tension could be built up by that. (Doesn't sound very commercial, does it?)

THE Urban Eyeball

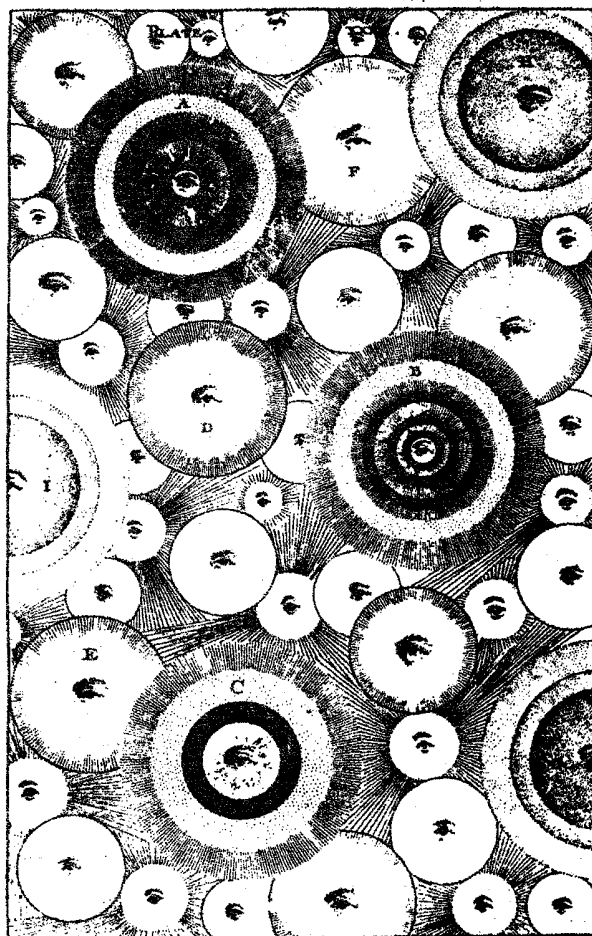
Part IV: the Summer Sky

Greg Ruffa

With the arrival of summer, the final quarter of our annual circuit about the Sun, the stellar arch of the Milky Way returns to the sky once more. As in winter, we are gazing into the disk of our Galaxy, but this time in the direction of its heart. Since we have discussed many of the constellations here back in Part I, we will concentrate on the southern sky.

Ophiuchus (with a hard "ch") surely earns a place on a list of constellations with strange-sounding names. It is the Serpent Bearer and was known by that name in early Greek astronomy. It is often identified with Aesculapius, the legendary first physician and direct ancestor of Hippocrates. His powers of healing were so vast that he could even resurrect the dead. Hades, lord of the underworld, so feared for the future of his position that he had Zeus strike down Aesculapius with a thunderbolt and place him in the heavens. The serpent he holds was a symbol of wisdom and the power of discovering medicinal herbs (hence the appearance of twined serpents on the *caduceus*, the emblem of the medical profession). There are many other stories associated with *Ophiuchus*, however. As constellation boundaries are now drawn, it is a zodiacal constellation, in that the Sun passes through it for three weeks; by comparison, *Scorpius*, a classical member of the zodiac, only finds the Sun within its confines for six days now. Although it is one of the larger constellations, *Ophiuchus* contains no particularly prominent stars.

Scorpius, the Scorpion, was the cause of Orion's death, according to myth. Even after both had been placed among the stars, his fear of the creature remained so great that Orion still retreats below the horizon when *Scorpius* rises. In classical times, this scorpion was also seen as the animal which panicked the horses drawing the chariot of Phoebus Apollo while it was in the hands of his son, Phaëthon. This led to the catastrophic careening of the Sun through the sky which seared or destroyed much of the world (producing, in legend, places such as the Sahara Desert). In ancient times, it was the largest of the Western zodiacal figures, as the figure of *Libra*, the Scales, was once taken to be the scorpion's claws. (The brightest stars of *Libra* are named *Zubeneschamali* and *Zubenelgenubi*, from the Arabic *Al Zubān al Shamāliyyah* and *Al Zubān al Janūbiyyah*, meaning the Northern Claw and the Southern Claw, respectively.) Alchemists assigned especial significance to *Scorpius*, believing that the transmutation of lead into gold was only possible when the Sun lay in that constellation.



The brightest luminary of Scorpius is *Antares*, whose name derives from *anti Ares*, meaning "similar to..." or "rival of Mars," owing to its color and brightness. It is a red supergiant star, the diameter of whose disk has been measured through the use of interferometry at 0.041 seconds of arc. At an estimated distance of 520 light-years, this means Antares is 700 times the size of the Sun or about 600 million miles across; in terms of our solar system, it would extend beyond the orbit of Mars into the inner asteroid belt. It is about 9000 times more powerful than the Sun and somewhere between 10 to 15 times the Sun's mass. Since the center of its brightness does not seem to be at the center of figure, Antares may be somewhat oblate or even egg-shaped. Its surface temperature is 3100 K (5100° F.) and its brightness is slightly variable. Such variability is typical of aged massive stars, making Antares, like Betelgeuse in Orion, a candidate for becoming a supernova anytime in the next million years or so. If that explosion occurred right now, Antares would be visible in the daytime sky for months and we would receive a considerable blast of high-energy particles, disruptive but not lethal (probably...). This star is joined by a main sequence blue giant companion; it is not known whether the two are simply travelling together or actually in orbit about one another. The surrounding region is a large reflection nebula, a cloud of interstellar dust some five light-years across, glowing redly in the reflected light of Antares. It is part of a much larger region of continuing star formation, about which more shortly.

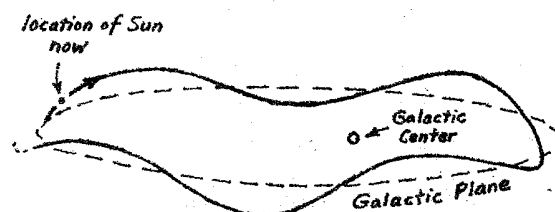
At the nether end of Scorpius lies *Shaula*, probably stemming from *Al Shaulah*, the "stinger," where this star appears, or perhaps from *Mushālah*, meaning "raised," referring to the scorpion's barb being poised to strike. It is a main sequence blue giant 1700 times more luminous than the Sun, lying some 310 light-years away. It is very slightly variable in brightness and may also be a spectroscopic binary.

Sagittarius comes to us from the Latin term for this constellation, which was seen as an Archer as far back as the time of Babylonia. This figure was most commonly represented as a fierce centaur with his arrow aimed at the Scorpion's heart, in contrast to the cultivated Chiron, who appears in the sky as Centaurus. Nowadays, the brighter stars, as marked on the accompanying maps, are often seen as the Teapot, complete with handle, spout, and a sort of peaked lid; the Milky Way seems to rise above it like steam.

In this general direction of the sky is a zone where stars are even now coming into existence: it is designated the *Scorpius-Centaurus Association*. It is a large, scattered group of hot, massive stars spread across about 90° of the sky through Crux, Centaurus, Lupus, and Scorpius; most of it is too far to the south to be visible in the United States. The Association is part of the still larger *Local System* or *Local Star Cloud* (alas, some astronomical terms are not terribly imaginative or colorful), a segment of what we call the Sagittarius Arm of the Galaxy. This region is much like the area around Orion, which we have discussed previously. This is the closest such collection to us, the center being about 550 light-years away and some of its stars are as near as 450 light-years. The member stars of the Association are identified by their apparent motion toward a common point on the sky; about a hundred stars are known to be part of it, though there may well be many more members. Besides being the brightest of its stars, Antares is probably the most massive, as it has already become a red supergiant. From the positions of the member stars on the Hertzsprung-Russell Diagram, the Association is thought to be less than 20 million years old. As is typical of stellar associations, the group is slowly expanding and will gradually merge into the disk of the Galaxy.

A well-known configuration to star-gazers, though not regarded as a constellation, is the "Summer Triangle." This consists of the bright stars Vega, in Lyra, Deneb, in Cygnus, and Altair, in Aquila. Nearby is a point indicating the approximate direction in space toward which the Sun is moving as it orbits through the Milky Way.

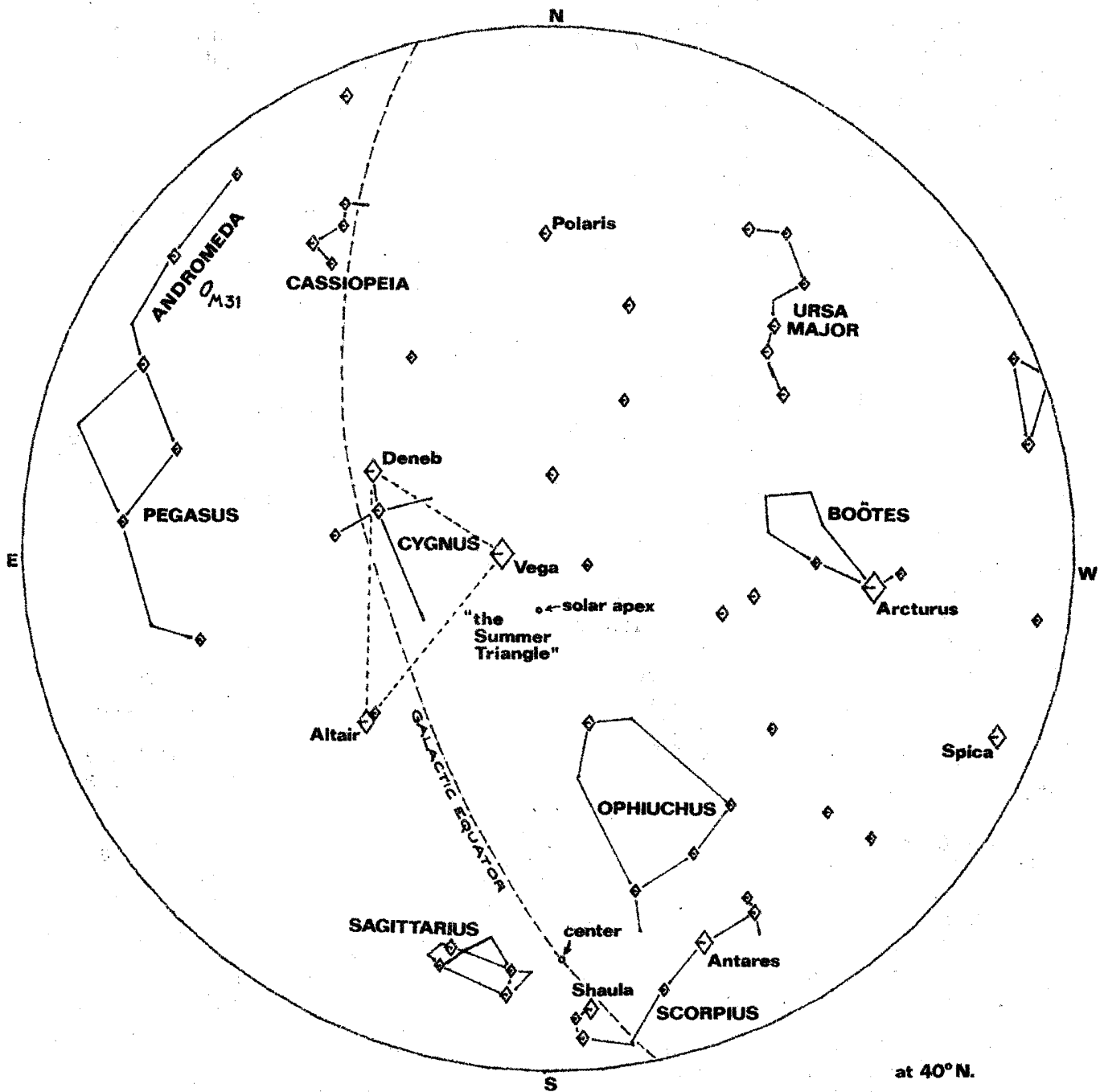
This point is called the *solar apex*. The speed and direction of the Sun's motion is estimated statistically by noting the average rate at which certain classes of stars appear to be passing our Solar System; the apex is marked by the direction away from which they seem to be moving. The result of such a statistical analysis depends, as usual, upon what data one includes in the survey.



Schematic representation of the Sun's galactic orbit

According to one approach to the problem, the Sun is headed toward the point shown at about 12 miles per second. It may be seen that the Sun is moving out of the plane of the Galaxy, in the direction referred to as "Galactic north." We follow a slightly elliptical orbit around the core of the Milky Way, in which we are presently passing our apocenter, or greatest distance from the hub. Due to the slightly complicated nature of the Galaxy's gravitational field, our orbit is not in a single plane; rather, we move up and down through the plane of symmetry, like a horse on a carousel. We complete roughly seven of these oscillations for every two circuits around the Milky Way, the orbital period being around 250 million years. Various potentially hazardous effects have been attributed to our passage through the Galactic Plane, such as increased likelihood of exposure to nearby supernova detonations or disruption of our surrounding comet cloud (causing drastic increases in the number of comets passing through the inner Solar System); these suggestions are highly controversial, however. In any case, our last crossing was a few million years ago, making the next one some thirty million years off (we can probably get ourselves into other trouble before then...).

The *Galactic Equator*, as drawn on our maps, represents that great circle on the Celestial Sphere which most nearly approximates the plane of symmetry of the Milky Way. In the constellation of Sagittarius, just west of the Teapot's spout and not far from the Scorpion's barb, is the direction to the *Galactic center*. In the 1920's, not long after the realization that we did, in fact, live in a Galaxy among galaxies, attempts to determine the location of the Center were under way. These were generally accomplished by studies of stellar motions and the positions of the globular clusters which surround the Milky Way; such dynamical investigations gave results in close agreement with contemporary estimates. The actual Center cannot be seen because we live so close to the Galactic Plane, so that vast numbers of stars and a great thickness of interstellar dust blocks our view. (This may be rather fortunate for us: the hub of the Galaxy would be visible by day otherwise and the copious amounts of ambient high-energy radiation from the core might have made the Milky Way uninhabitable!) With the emergence of radio astronomy in the 1930's, it became possible to detect long-wavelength emissions from the Galactic band and to "see" the nucleus, albeit at low resolution. Since World War II, radio astronomy has undergone enormous refinement; moreover, the development of orbital observing platforms allows us to collect high-energy radiation which manages to penetrate the dust clouds but not our atmosphere. Around the mid-1970's, the Galactic Center came to exist as a place in our considerations. Its direction is known



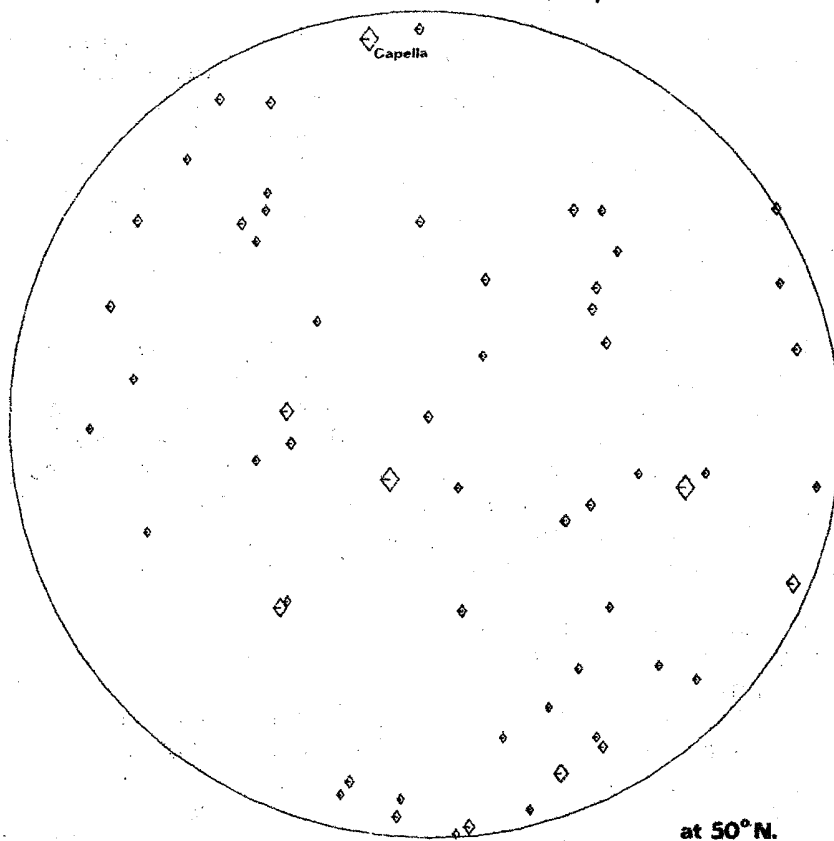
the sky at eighteen hours sidereal time

it appears as shown at:

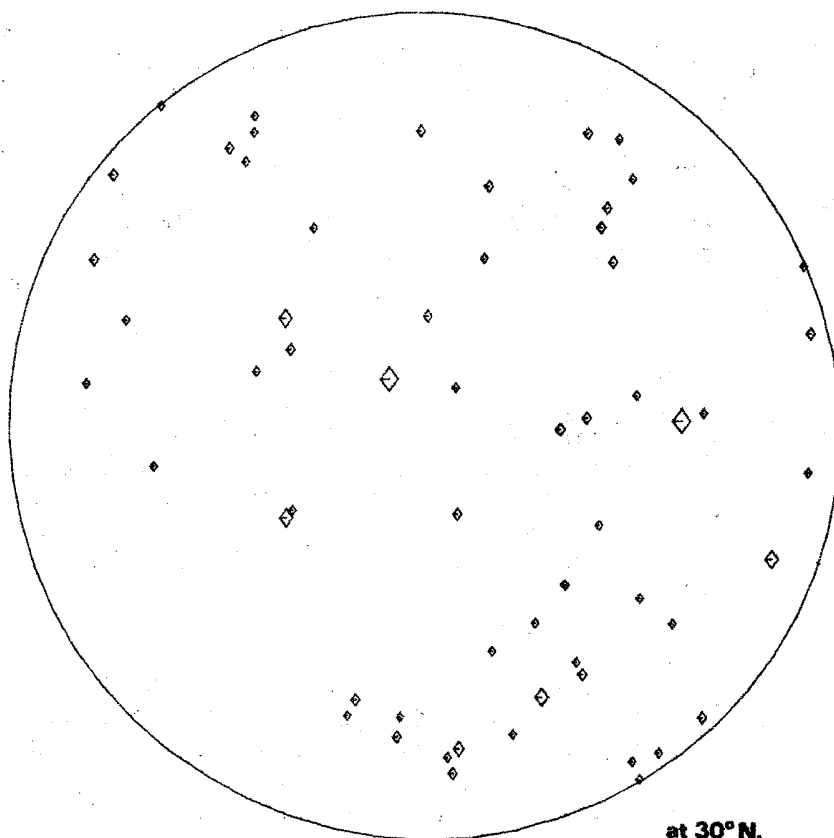
12:20 AM local daylight time on 1 June

10:20 PM " " " on 1 July

8:20 PM " " " on 1 August
(may not be completely dark at this time)



at 50°N.



at 30°N.

to a fraction of a second of arc: it is identified with a powerful source of all manner of electromagnetic radiation called *Sagittarius A West*. The distance to this location is not nearly as well known; our dynamical studies suggest a value of somewhere between 28,000 to 33,000 light-years from us. Based on our current theories of how galaxies form, it is thought that we are looking at an extremely massive black hole of some 100 million times the mass of the Sun and about the size of the known Solar System. The activities taking place about the core are under intense scrutiny; there is not yet a strong consensus as to just what is going on in there.

We have looked at two dozen star systems in this series. We may conclude from our brief survey that the brightest stars that appear in our skies tend to be either nearby and of moderate luminosity or else remote, brilliant, and dying. Most stars appear too faint to stimulate our color vision and so look white to us. Of those which we do see as having colors, most are either truly white or blue-white; just a few are yellow, orange, or red -- and most of the orange and red ones are giant or supergiant stars (otherwise, stars of those colors are too feeble of output to be seen at all by the unaided eye).

If our own example is at all representative, intelligent life requires a few billion years of stability on the part of the home star in order to evolve to a level where it may contemplate such matters as these. As we have seen, the massive, brilliant stars expend themselves rapidly and then are no more. Only the smaller, more modest stars survive long enough for the mechanisms of geology and biology to do their job. Beings like us, if they exist anywhere else, will probably be found huddled only near such stars -- stars which are faint and inglorious in our skies and are given names only by the denizens of their worlds.

* * *

The illustration found at the beginning of this final installment is a reproduction of Plate XXXII from "Letter the Ninth" of An Original Theory of the Universe (1750) by Thomas Wright (1711-1786).

My principal source for the mythological material in these articles has been Star Names: Their Lore and Meaning (1899) by Richard Hinckley Allen; it remains available as reprinted by Dover Publications. Supplementary books were Edmund Fuller's abridgment of Mythology (1855-63) by Thomas Bulfinch (from Dell Publishing Co.) and The Greek Myths (1955), in two volumes, by Robert Graves (Penguin Books).

The chief reference for most of the scientific details about the stars was Burnham's Celestial Handbook: An Observer's Guide to the Universe Beyond the Solar System, revised edition (1978), in three volumes, by Robert Burnham, Jr. (Dover Publications); this compendium also contains much on star lore, as Burnham himself quotes and expands upon Allen's scholarship. Some further scientific details were taken from Galactic Astronomy: Structure and Kinematics, second edition (1981), by Dimitri Mihalas and James Binney (W.H. Freeman and Company). Additional material and the general context for the articles arises from my own education as an astrophysicist.

The Urban Eyeball has appeared in Pyrotechnics, numbers 34, 35', 36, and 37. Number 34 (1983) predates the period of publication from San Diego; it also contains an extensive article on geosynchronous communications satellites. A dozen copies remain and may be purchased from this author for \$1. Copies of Part One of this series may be had by sending a self-addressed, stamped envelope.

THEY CAME IN THE MAIL

compiled by Gail Hanrahan

These are the zines we've received in response to the last PyroTechnics mailing. I'm listing them more or less in the order I found them stacked. Since we haven't been very careful about putting things away of late, this really means that they're in no order at all! Anyone who's in the area and wants to come and look at the zines is welcome to do so. I hope that in the next issue of Pyro, I'll have time to do some short reviews instead of just a list.

* * *

Baton Rouge SF League Newsletter, #42-43
P.O. Box 14238, Baton Rouge, LA 70898-4238

Undulent Fever #10
Bruce D. Arthurs, 5316 W. Port au Prince, Glendale AZ 85306

Transmissions #205,208-209,211, 213-214
Nova Odysseus (United Gulf Coast Fandom)
P.O. Box 1534, Panama City FL 32402-0123

The Dillinger Relic #45-47
Arthur D. Hlavaty, 819 West Markham Ave., Durham NC 27701

Lan's Lantern #19-20
George Laskowski, 55 Valley Way, Bloomfield Hills MI 48013

DASFax Vol. 18, #4-7
Denver Area SF Association Newsletter
DASFA, Don C. Thompson, 3735 W. 81st Place, Westminster CO 80030

Factsheet Five #18
Mike Gunderloy, 41 Lawrence St., Medford MA 02155-4123

Instant Message #399-404
NESFA, Box G MIT Branch P.O., Cambridge MA 02139-0910

Bcsfazine #156, 159
British Columbia SF Association
P.O. Box 35577 Station E, Vancouver BC V6M 4G9, CANADA

Write On
Judy St. John, Editor
WWF, Route 6 Box 344 A, Carthage MO 64836

Science Fiction Review #59
Richard Geis, P.O. Box 11408, Portland OR 97211

Xenium 14
Mike Glicksohn, 508 Windermere Ave., Toronto, Ontario M6S 3L6, CANADA

Scavenger's Newsletter #27
Janet Fox, 519 Ellinwood, Osage City KS 66523

De Profundis #171-172
Los Angeles Science Fantasy Society, 11513 Burbank Blvd.,
North Hollywood CA 91601

Elitist Ennui #33, #35-38
Alex McKale, 812 Clark St. #2B, Evanston IL 60201

NASFA Shuttle January - August 86
North Alabama SF Association, P.O. Box 4857, Hunstville AL 35815

Smart-Ash #31-32
Chimneyville F&SF Society, c/o Ruth & Rickey Shields
1410 McDowell Road, Jackson MS 39204

Space & Time #70
Gordon Linzner, 138 W. 70th St. (4B), NY NY 10023-4432

The SF Convention Register, April-May, June-July 86
Erwin S. Strauss, 4271 Duke St. #D-10, Alexandria VA 22304.

FOSFAX #104-105
c/o Falls of the Ohio SF & F Association, P.O. Box 37281,
Louisville KY 40233-7281.

ANVIL #40
Charlotte Proctor, 8325 7th Ave. So., Birmingham AL (no zip?!)

Holier Than Thou #24
Marty Cantor, 11565 Archwood Street, North Hollywood CA 91606-1703

WAHF-FULL #16
Jack Herman, Box 272, Wentworth Bldg.,
University of Sydney, NSW 2006, AUSTRALIA

Neology Vol. 11 #1-2.
Edmonton SF & Comic Arts Society
Box 4071, Edmonton, Alberta T6E 4S8, CANADA

Gilgamesh #69; Diaspar #23
Terry Carr, 11037 Broadway Terrace, Oakland CA 94611

Tigger #17-19
Marc Ortlieb, P.O. Box 215, Forest Hill, Victoria 3131 AUSTRALIA

Maple Leaf Rag #21-23
Garth Spencer, 1296 Richardson St., Victoria B.C. V8V 3E1 CANADA

Mentat #57
Bill Seligman, 667 Rugby Road, Brooklyn NY 11230

Sticky Quarters #14
Brian Earl Brown, 11675 Beaconsfield, Detroit MI 48224

Maybe #66
Irv Koch, c/o 835 Chatt. Bk. Bldg., Chattanooga TN 37402

Interphase, Vol. 13, #7-8. (STAR San Diego Newsletter)
c/o Jim Hay, 6333 College Grove Way #L-11, San Diego CA 92115

FALLOUT

PYRO PRODUCTION

/*

* Harry Warner, Jr.

*/

Me and my big fingers: I write stuff about how hand stencilling is so superior to electrostencils, and then I find in this issue of Pyro some illustrations which couldn't be better reproduced, no matter what technique had been used. I suppose they're electrostencilled, since it's pretty hard to do offset on the same page as mimeography and have the two elements look compatible. I was impressed particularly by the illustration for the first page of book reviews. It conveys the solidity of those heavy volumes beautifully. In fact I kept listening while reading the rest of the issue because I felt sure the pile on the left would be crashing down soon, the way books always do when I pile them up like that in my cluttered spare bedrooms.

[Uh. Well, I hate to admit it after such glowing praise, but as I said in the closing remarks lastish, a few copies of that page were Xeroxed (tm). That design sucks ink off the screen like a sponge, making it hard for the separator fingers to peel the sheet off. As you can see, Gail has done an outline version for thish which, while less impressive, is considerably less challenging to print. -- JEH]

/*

* Bill Higgins

*/

Pyro really looks great! It's as well produced as any fanzine I've seen. The work you guys put in shows on every page. Hardly even any typos. I noticed that you took special care to place the cartoons in appropriate places in the text. ("Yay! Somebody noticed!") Sending it to fanzine fans is working well, too. I always wanted GT to have more to do with them, and Pyro is becoming a crossroads where the two can overlap.

I'm impressed with the locs, too. I'd like to see more space devoted to readers' reaction -- though I know the volume of mail you've got threatens to turn Pyro into a loczine. And such names! Alexis Gilliland is reading our stuff! Harry Warner!! ***WALT WILLIS**!!!! It's like have Ziegfeld drop into your summer-stock theater.

[As long as we keep getting these comments, I'm likely to keep including them in the lettercol. It's nice to hear that our relatively low-tech repro is more than acceptable to our readers! -- GBH]

GEORGE EWING'S FLORIDA SPACECOAST SILLY PYRO SUPPLEMENT

/*
* Mike Glicksohn
*/

Despite their slightly dated contents, George Ewing's various media reviews were highly enjoyable, primarily due to his highly individual and delightful writing style. I particularly appreciated his extremely clever use of metaphors and comparisons which added a freshness to the writing that more than compensated for the age of the material being considered. This is damn good stuff and was certainly well worth publishing, even now.

/*
* Greg Ruffa
*/

I haven't seen an old-style Pyro (from what we call the Before Time) in so long that I'd forgotten what they read like. So it was fun to read George Ewing's "green pages" which are now so divergent in style from the rest of this rag. I hope he's got some more recent stuff coming.

[Rag? Did I read that correctly, Greg? -- GBH]

/*
* Harry Warner, Jr.
*/

The green pages were amusing to me and I'm sure they were hilarious to those who understand properly the more technical aspects of their humor.

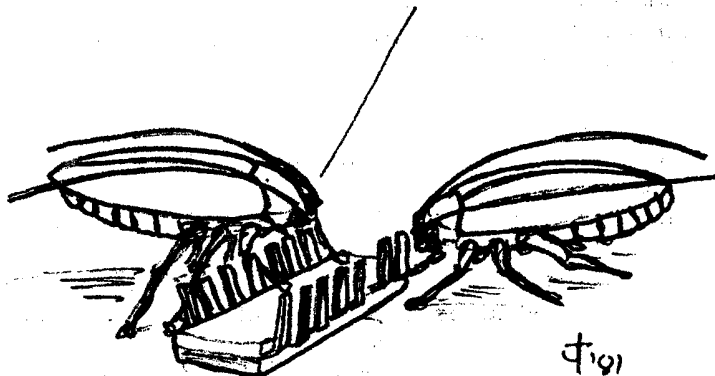
[I'm afraid I have to second these sentiments. Most of George's humor had to be explained to me. I don't need to know anything about electronics to swap boards in a computer.... -- GBH]

JAMES CLERK MAXWELL'S SILVER HAMMER AWARDS

/*
* Alex McKale
*/

I'd nominate Reagan's SDI program for all the real world Silver Hammer Awards were it not for the fact that I feel the program more appropriately belongs under the fiction heading.

I THINK THE POOR DEVIL'S DEAD...



/*

* Lee Hart

*/

I feel compelled to nominate the TV program "MacGyver" for most obviously bogus pseudo-science. The program not only shows bad tech, it actively promotes it as one of the main attractions. I have yet to see a gimmick that would actually work as presented. The sad thing is that most of the ideas could conceivably work, if they had just checked up on their facts. The writers for MacGyver are in desperate need of a techie consultant.

[I've heard that the producers/writers of this show deliberately alter or omit something from each of their gimmicks so that if anyone tries it as portrayed in the show, it will not work. Whether this is true or not is anyone's guess; I certainly don't know, since I've never seen the show. -- GBH]

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* Walt Willis

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At least I recognized the origins of the Silver Hammer. A Times columnist castigated a waterproof radio as the ultimate in useless gadgets only to be told by a reader he had been looking for one for years, to listen to the 8am news in the shower.

There has not been much hi tech discussion in Irish Fandom since George Charters complained of a sore neck brought on by watching tv in bed. "You should turn the set on its side," I advised. "You mean to tell me that when you turn a tv on its side the picture comes out sideways?" "Yes," I said, "Why do you doubt it?" "Well," said George, "when you turn a radio on its side, the music still comes out the right way up."

ON VARIOUS REVIEWS

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* Bill Stoddard

*/

While the point Barry Gehm makes about the book version of Return to Oz seems valid, I think it should be noted that the film is excellent -- to my taste, better than the original Wizard of Oz film. Beyond that, it manages with startling ingenuity to fuse the plots of the second and third Oz books -- The Land of Oz and Ozma of Oz -- thus solving a problem Baum ran into, the incompleteness of the Oz stories without Dorothy, without simply skipping into the third book and leaving the events of the second unexplained. In doing so, it manages to preserve many of the crucial episodes of the two separate books while fitting them into a unified plot. Someone at Disney showed true respect for L. Frank Baum's work in doing this film.

Chuq von Rospach's review of Job seems to object to satire as such. Certainly Heinlein wasn't being sympathetic to bible-belt fundamentalism or its gods. Why should he have been? A good satirist's job is to destroy the object of his satire. My main complaint about Heinlein's work is that his satire's a little too obviously indebted to (oh, Hell, why be polite? -- "stolen from") James Branch Cabell's Jurgen, a classic mix of ribaldry, fantasy, and satire, whose hero also visits Heaven and Hell. But I doubt that anyone could improve on the classic assaults on bible-belt religion by Cabell, Mencken, Twain, and their like; perhaps Heinlein was

sensible in not trying. In any event, whatever one thinks of Christianity (I personally think it's pretty ugly, but not substantially more so than average for a major world religion), the fundamentalism Heinlein makes mock of deserves everything he did to it and then some. Job has faults, but the vigor of its satire is not one of them.

[I just object to it on the basis that it's a bad book. -- GBH]

/*
* Brian Earl Brown
*/

Barry Gehm's righteous indignation at the absense of L. Frank Baum's name from the novelization of Return to Oz ought to be tempered with the realization that Del Rey reprinted all of Baum's Oz books a few years back.

/*
* Greg Ruffa
*/

I enjoyed William Stoddard's article on molecular biology and the New Taxonomy (no, that isn't the thing Congress is working on...). Biology sure has changed since I took it in high school, away back in '68. The Gaia Hypothesis makes me squirm a little, especially as I've seen it used to claim that billions of stars have habitable planets because the biosphere "knows" how to stay alive. The teleological implications seem difficult to justify. It seems more likely that a highly diversified ecological system has a better chance of surviving in a broader range of changing circumstances than a simple system. Nevertheless, I doubt that in four billion years, when the sun will be thirty percent brighter, that anything will still be alive here. (The wonderful thing about that remark is that probably no one will call me on it.) I saw a suggestion by someone once that so-called "gray-life," which is to say sufficiently sophisticated electronic devices, be labelled the "fourth kingdom"; that was before Moner and Fungi got their own turf. Anyone here like the idea of a Sixth Kingdom?

SPACE TRAVEL, PRIVATE AND OTHERWISE

/*
* Lee Hart
*/

OK, so how do we get a space ship? Idea #1: My friends in Detroit tell me there is one tried and true method of getting anything you can't afford -- steal it! [...]

Idea #2: The L. Ron Hubbard Approach. Building the ship is going to cost a whale of a lot of money. Religions can raise lots of money, so let's create one. The prime tenet of our new faith is that god is calling us from the stars. It's like the cults that believe flying saucers are coming, only we believe that we must go out to meet them.

Each member of the faithful needs the proer articles of worship; a satellite receiver to receive his messages from the divine source, video equipment to record the scriptures, a home computer to interpret it, etc. Since religions are tax-free, all this is tax exempt and we can attract converts in droves.

Idea #3: The Jules Verne Approach. The idea of a big gun to shoot something into orbit isn't as unreasonable as it seems. I understand the Canadians came darned close with a specially modified Naval gun shortly after WW2, although electronics in those days had trouble handling the G-forces. [...]

Idea #4: Send A Proxy. Now let's get a little more serious. If we can't get into space ourselves, how about doing it indirectly? The ham radio operators have orbited over a dozen OSCAR satellites. AMSAT, the Amateur Radio Satellite Corporation builds the satellites with volunteer labor, surplus and donated parts, etc. When finished, they talk someone into giving them a free ride aboard a foreign or military rocket. The ham satellite goes along as ballast (to round out a payload or fit in leftover space), or on a test launch that no one wants to risk a multimillion dollar communications satellite in. [...]

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* Greg Ruffa

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As I finally sit down to write my letter about Pyrotechnics #37, it is the afternoon of June 1st. I'm happy to say that your worst fears about public reaction to the Challenger disaster were not realized. (I guess Reagan's still got America lodged deep enough in the fifties that the country is still hopped-up about space...) Still, this is getting to be a pretty depressing year. Arianespace just had to blow up another one the other day (I heard the news last night). That's two failures for them since last autumn, plus one Shuttle, one Titan, and one Delta (a DELTA!? Deltas don't blow up...). We were scheduled to have an Atlas-Centaur launch on May 22nd (I work at General Dynamics), but that's postponed until at least June 19th, awaiting the outcome of the Delta failure investigation (there is certain key hardware in common). Because of all this, the Shuttle-Centaur program may get canned and all of the pending planetary missions will be launched no earlier than 1988. (I have a personal bet going that the next significant results from another planet will be the Voyager 2 encounter with Neptune -- in August of 1989...) All of that makes it pretty hard to smile about the fact that we got some pretty wonderful stuff from Uranus and Halley's Comet.

It is not my intention to start an argument in these pages about what the future direction of the space program should be. (The National Commission has published its goofy guess and I'll have something to say about that elsewhere.) I will simply say for now that our present state of rocket technology is standing in the way of our good intentions for reaching into space. We have gotten too comfortable with a system that has an average five percent failure rate. That's not good enough for space development (as insurance underwriters have found to their horror) and it certainly isn't good enough for manned flight (we're about where aviation was in, say, 1910). One step it seems we ought to take is to forgo a replacement Orbiter and spend the money on research into



improving the reliability of rocket propulsion for the next generation of vehicles. It doesn't look like that's what's going to happen, though.

Well, I didn't want to sound like a stick in the mud about the idea of building a starship, but I thought it needed to be pointed out that the problem is just a bit harder than some people I've met seem to think. I also find it amusing, but not surprising, that I haven't heard a word about the matter since last issue...

/*
* George Ewing
*/

I was appalled as the techie details on the SRBs came out in the news. I knew that Ladisch machined the casings in sections; I don't suppose there's a lathe this side of the Smith Brothers' (E.E. and Geo. O.) workshop that could turn a complete SRB intact, but I had just naturally assumed they welded the rascals together and cast the fuel grain all in one piece. Rubber washers, bumper jacks, and silly putty? Jesus!

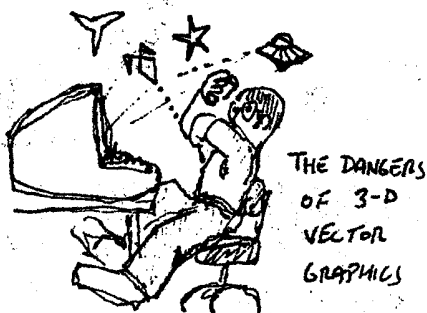
/*
* Garth Spencer
*/

So a shuttle blew up. This was not unanticipated. So everybody was busy fixing blame. Not hard to foresee. It is more to the point (a) why NASA felt rushed to get a shuttle off the pad anyway, (b) why O-rings weren't more robustly designed, (c) why Congress kept gutting the original Shuttle design, and all this boils down to: How do we design bureaucratic systems better in the future; and what are our real objectives, and what are we accomplishing, anyway?

I and one or two friends are edging up on ideas towards an applied sociology, or social engineering. Is there anyone anywhere doing the necessary human factors/game theory research? I'd have to throw in things like systems analysis and Neuro-Linguistic Programming. Come to think of it, I'd also have to throw in information theory, economics, political economy... Um. You just hang on; I'll acquire degrees in four or five disciplines and get back to you.

/*
* Harry Andruschak
*/

I do not think we should buy another shuttle. Why? Because it is a total 100% failure. The shuttle was supposed to launch cargoes into orbit at one-tenth the cost of the Expendable Launch Vehicles (ELVs). In truth, it costs much more to launch cargoes with the shuttle than with the ELVs. So why buy another shuttle and throw good money after bad?



Well, of course, there is the argument about the need for a manned presence in space. Sure, we need that. But if we use ELVs for all the cargoes that do not need a manned presence, and use the shuttle for only the essential manned missions, how many do we need? Answer: Three. Source: Aviation Week and Space Technology.

We still need to get into Earth orbit at one-tenth the current cost if space is to be opened

up. The shuttle cannot do it, and to buy more shuttles only makes it harder to build something better. Far more realistic is to admit the shuttle is a total failure, bring back the ELVs as a stop-gap measure, and concentrate on some sort of heavy-lift vehicle to get into orbit cheaply.

[Just before I typed this letter in, the 11pm news reported that the President is expected to announce tomorrow, 11 August, that another shuttle will be built. They noted that means of paying for this shuttle had not been determined. It seems to me that Greg's views (stated above) are more far-sighted than those of the folks that just want another shuttle. If we must build something, we should at least try to build better this time around, and that means taking the time to do the research to do it right. Once again, American government (like American business) demonstrates an apparent inability to look farther ahead than this year's election, or this year's results. What else can I say? -- write your Congresscritters, whatever you think. -- GBH]

TECHIE TRIVIA QUIZ

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* Greg Ruffa
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I'm afraid I'm going to flunk the Techie Quiz, though: I couldn't get my hands on any NBS-approved earwax-saturated steel wool...

[Yuck. -- GBH]

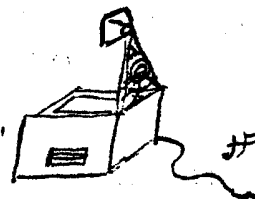
/*
* Robert Coulson
*/

None of your answers for SCA in the quiz is correct. It's actually a garbage collecting service, based in Muncie, Indiana. It collects trash from various factories, including the Overhead Door Co., when I worked there. I think I have a photo of one of their trucks, if you don't believe me. I'm afraid I'm not sure what the initials stand for; I've seen their trucks and trash bins, but never called the company to ask. None of your answers sounds right, though. (Phone book just lists them as SCA of Muncie.)

ON GT

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* Greg Ruffa
*/

I do hope to hear from people about my GT article. I know that there are people in the Mob who are involved in such activities [teaching and etc.] and would like to see them write about their ideas. One problem I noted in the layout is that the last two paragraphs are literally redundant. While it's said that a good idea is worth repeating, I doubt mine are that good.



/*
* Alex McKale
*/

The difficulties I have with educating the masses are: (1) Ignorance is vry real even though interest is high. You have to start at absolute ground zero. By the time you get to the neat stuff that you've been doing, the change that they understand what you're doing is small. (2) It takes time away from my work, which is why I'm in this game to begin with.

Don't get me wrong. At one time I was all set to be a science journalist. I was going to get a Ph.D. and then go out there and explain things to the common folk (at least those who read the science section of the New York Times). The problem I now hoave is that people expect science to be entertaining; it is not. [It's more like] trying to look up Mother Nature's skirt, and the old lady is hell bent on stopping you. But you keep trying and every so often you get a glimpse. It is not entertaining; it is hard work. But it is fun. When one tells others of one's discoveries, they seem silly unless the others have been looking up the same skirt.

COMPUTERS IN SF

/*
* Greg Ruffa
*/

It does seem odd to me that so little contemporary SF deals with computers as anything more than an adjunct to human activity. It's as if the closer we get to something like real AI, the less interest there is in dealing with it as a fictional theme. Maybe the first strong novel about a sentient machine will have to be written by one (but what of its commercial potential in the human sector of the market?). I suspect that since we don't really understand how human "intelligence" comes about, we won't realize when we've achieved the artificial kind. (I had a fantasy today about the discovery of the first self-aware computer. Someone is sitting at an interface device, circa 2020, working away on something, when up pops the screen "Do you mind if I ask you a question?"

/*
* Harry Warner, Jr.
*/

I'm not so surprised at the tendency of science fiction to use computers as villains. Science Fiction likes to turn into villains almost anyone and anything in the news, except dolphins. I'd dearly love to read a novel in which all the dolphins are deceitful, stupid, enemies of mankind, and incapable of being taught. It would be a wonderful change. And you must admit that computers have shown some inclination to live up to their fictional role, particularly in fandom, where some of them have eaten fanzine material before it could be transmuted into type and others have hypnotized their owners into inability to do anything but talk about computers, virtually ending their careers as fanzine publishers.

* * *

WE ALSO HEARD FROM:

P.L. Caruthers-Montgomery, Cathy Doyle, Janet Fox, Richard Gilliam, Ben Indick, LCpl. Wendell M. Joost III, Paul Tortobici, Laurraine Tutihasi, and Franz Zrilich.

Oops: One of us typo'd the address for the North Alabama SF Association in lastish. The correct address is: Box 4857, Huntsville, AL 35815.

GAIL'S TWO CENTS

Many of you may not be aware that Jamie and I were up to our necks running Westercon this year (I chaired it and did the publications, he ran logistics and operations). So that's our "why Pyro is so late" excuse -- I think it's at least a fair one. Our original plan was to pub in May, leaving the month before the con open for con-stuff. This plan went pretty much by the wayside in April, for two reasons: we got really busy with con-stuff earlier than we expected, and, sadly, my father passed away after many years of illness with leukemia. I miss him.

Didn't have as many letters as last time, or at least not so many that struck me as being amusing or interesting enough to re-type, given the urgency we feel about getting this issue out. This letter column has been done in, oh, about six hours, and that includes scanning through the letters and deciding which and what to use.

One request: if you feel that a section of your letter has been taken out of context and thereby distorted, PLEASE let me know. I think I managed to avoid this, but what I read may not be what you think you wrote.

With this issue of Pyro, and with Westercon being OVER, Jamie and I should be able to get on to a regular schedule now. We'll see. You folks have to do your part by sending us articles, art, reviews, art, essays, art, and so on...

Later.



"Why Times are Hard for Hard SF" -- continued from page 5

Specialists will always nit. This writer received a spousal elbow in the ribs during a Star Trek movie when blurting, "But a nebula wouldn't look like that." There is an anecdote about two scientists, an astronomer and an anthropologist, discussing Velikovskian theories. The astronomer says, "Well, his astronomy is crackpot but the anthropology is damned interesting." The anthropologist looks blank for a moment and says, "No, it's the other way around." Chances are that if a nit picker is pleased with an SF work, either the holes are outside his area of knowledge or the work has a very limited scope. Science fiction is fiction, not science, and it will remain that way.

PROGNOSIS

Despite the fact that hard SF is under siege, I have a sense of optimism about its future. Traditional hard SF survived the New Wave, becoming stronger and more resilient as a result from the encounter. Now, the Cyberpunk Wave is simultaneously challenging traditional hard SF while infusing a new vitality into the field. Thesis-antithesis-synthesis; I feel that hard SF will endure the problems that I've outlined. It may take longer for writers to become competent in the hard SF field, but the impulse will remain and the rewards, both economic and artistic, will guarantee that good hard SF will continue to be written, if not in the quantity that we might like.

BACKMATTER

Well, here we are again: At the end, but not quite, since the TOC and colophon pages still remain.

Production of this Pyro has been greatly facilitated by our acquisition of a second Kaypro. The other one we bought used; I assembled this one from surplus components at a substantial saving. However, Kaypro cases are hard to come by, so I bolted the monitor, power supply, and mainboard into a plastic milk crate (the floppy disk drives sit in a stack by the crate's side). The result will take any and all prizes for silliness, but I don't expect ever to have thermal problems! Both machines have been upgraded to be Kaypro 8's (an unofficial designation for a machine with a new monitor ROM that'll let it use 760Kbyte floppy drives), so, naturally, this contraption has been dubbed the "Kr8pro". It doesn't travel well, but it works like a champ! I don't know how we could have done everything we had to do for Westercon without the second machine. (In these less hectic times it serves as a print buffer.)

"Damn! Now I'll have to do all those things I said I would do after Westercon..."

--JEH at the dead dog party

Gail has already mentioned that we had a rather large part in Westercon this year. I really do want to put this issue to bed, so numerous tales of magic and wonder will have to wait 'til nextish: The story of how the stencil cutter died a week before the con, and how I found a TV repair shop that stocks 931A photomultiplier tubes and that was open on Saturday (no, the PMT wasn't bad, but I was troubleshooting via the scattergun approach); of how we equipped the masquerade with some of the best lighting and sound that anyone's ever done at a con; and of the International Penguin Conspiracy panel. (Don't ask.)

But we survived; I fixed the stencil cutter and we got nearly 100,000 impressions finished in time for the con (but just barely); and the con had over 2500 members, more than any Westercon since 1979.

In contrast to previous cycles, we are already gathering material for nextish. We have one or two articles that couldn't make it in this time, and we hope to have something from Bill Higgins. But we need more! And we need artwork. Now, some of you blessed folk who have sent us cartoons (Brad Foster, Alexis Gilliland, Bill Rotsler, Greg Ruffa, Paul Tortobici, to mention those who come immediately to mind) will be thinking "But, they haven't used everything I sent them yet!" Alas, not everything fits everywhere. We do make some effort to find illos that bear some relationship to the nearby text, and the size of an illo has to fall within a certain range depending on what text it's next to, or above or below... So, even though we have quite a few things we haven't used yet, we don't have enough! ("More, more, I'm still not satisfied...")

There was not enough response re. the James Clerk Maxwell's Silver Hammer Awards to do anything about them this year. I still think it's a good idea; we'll try it again for 1987, perhaps in slightly different form. (Perhaps just two awards -- one for fiction and one for the real world. Or maybe just one. Maybe we can get Glycer and Weinstein (sounds like a law firm) to include it on the Hugu and Blackhole ballot. Suggestions, anyone?)

PYRO PATS ITSELF ON THE BACK

Several GTers have wondered how Pyro is being received by fandom at large. These are comments Pyro has received in other fanzines, or at least the ones Gail could find while skimming through an eight inch high stack of zines. It's our contributors who really deserve this praise:

In Maybe #66, Irv Koch listed us as the best of the clubzines. "Virtually every feature they have is near-pro quality or better, not to mention being "fannish" so I won't try to list [all the notable items]. The "Lights of Known Space" jokes stood out even here however. This is also the closest to a genzine of all the clubzines -- in fact it IS an old fashioned 1965 genzine reincarnated by accident."

In Factsheet Five, #18, Mike Gunderloy listed us as "A sfanzine published under the auspices of General Technics, a group of fans who still goshwowoboyoboy about technology and space shuttles and stuff. Half reviews of SF books and movies, half techie articles, half letter column (and don't ask me how they managed that!) Crazy ideas float around GT, from submitting locs by modem to forming a corporation to build a starship. Fun stuff."

In the July issue of the NASFA Shuttle: "A large, meaty, & fascinating production. Both the club & PLCM received copies -- and we are glad we did! [quote from Pyro colophon omitted] Nice calligraphed headings and excellent repro throughout. We like this one!"

In Neology, Vol. 11, #2: "A very good SF genzine, with emphasis on technology. Read this zine!"

The addresses of these publications' editors, who so obviously are possessed of an unusually high degree of wit, intelligence, and taste, are shown in the "They Came in the Mail" section. Seriously, we're tickled to death to get comments like these; besides the obvious egoboo, they give us something to point to when we're asked why we do this stuff.

BITS 'N' PC's

A glitch: A couple of people noticed that, in mentioning David and Susannah West-Powell's STARWIND lastish, we concluded by saying "write to them for more information" and neglected to supply their address! It is: Box 98, Ripley, OH 45167. For those of you who came in late, here's the whole story: STARWIND is "a quarterly publication for the young adult who has an interest in science and technology and who also enjoys reading well-crafted sf and fantasy". They're looking for both fiction and non-fiction, and some of the stuff that's appeared in Pyro would be just right. Payment is one to four cents per word, rights negotiable. Write to them for a full set of guidelines (free with a SASE) or for copies of STARWIND (\$2.50).

And yet another: We forgot to give Chuck Ott credit for the... uh... things at the bottom of page 42 lastish. He is also responsible for the item on the bottom left of page 27 this time.

Bill Higgins informs us that Todd Johnson has "enslaved Teddy Ruxspin". Teddy Ruxspin, for those of you who don't follow the kiddie ads, is a teddy bear with a cassette deck in his back and servos in his head. One track of the cassette holds audio, and the other is a control track for the servos, so Teddy can "tell stories" that are accompanied by facial expressions... or so I gather; haven't actually seen one. (Just what we need: More encouragement for parents to spend less time reading to their kids.) Anyway, Todd has figured out how to cut his own tapes. A filksinging teddy bear? "Coming soon to a convention near you!" Watch out, Filthy Pierre...

Barry Gehm wrote with a correction to his lead-in article on blimps: "Although I wrote that there were no longer any blimps in commercial service, I have since learned that Pan Am is using blimps to conduct aerial tours of some European cities. (Save your inflated currency, son, the blimps will rise again!)" Something to keep in mind if you're planning on going to Worldcon next year.

George Ewing notes that "IASFM has bought [his] 9.5 kword Future Trout Fisherman/Hemingway parody!" (don't ask us; that's straight from his letter) and that it is absolutely crawling with inside techie/GT jokes. He did not mention a probable pub date. (George, ask Jeff Duntemann how long Asimov's held on to "Cold Hands"....) He also has a nibble from another magazine; they are apparently interested in having him do a regular review column. All right! (But, George, you have to mention GT and Pyro in every third issue. At least.)

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